January/February 2001

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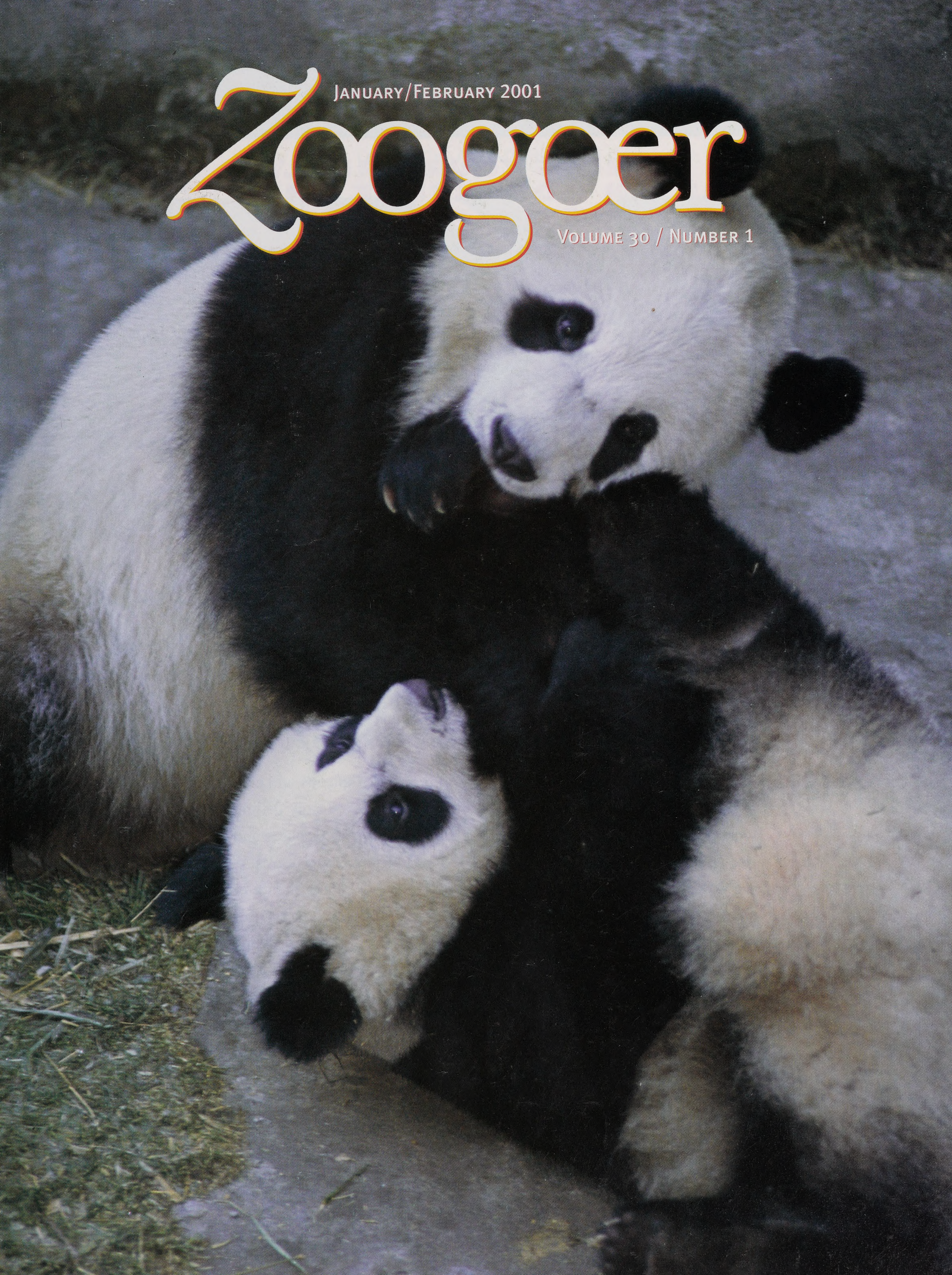

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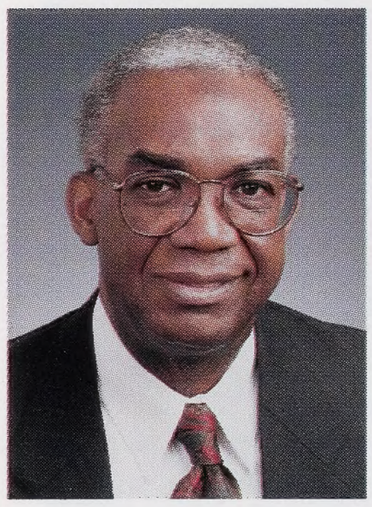
WELCOME, MEI XIANG & TIAN TIAN!

As we celebrate a New Year full of hope and promise, I am thrilled to welcome Mei Xiang and Tian Tian to the Smithsonian's National Zoological Park on behalf of Friends of the National Zoo. The delight of gazing upon these magnificent creatures is just as precious to someone like me who spent many years watching Hsing-Hsing and Ling-Ling at the Zoo as to someone seeing giant pandas for the first time.



Our members have much to be proud of. FONZ was the first organization to commit funds to the Zoo's effort to bring giant pandas back to Washington, D.C., from their native China. The Giant Panda Conservation Fund, which we launched in 1998, has helped support the renovation of the current panda exhibit, as well as much of the National Zoo's giant panda research over the last two years. FONZ's capital campaign also raised money to acquire Mei Xiang and Tian Tian and to build them a new exihibit—to be called the Fujifilm Giant Panda Exhibit in recognition of Fujifilm's $7.8 million contribution.

More remains to be done, however. We must raise additional funds in order to complete this spectacular new habitat, which is scheduled to open in 2003, and to make possible the ambitious conservation research that is a vital part of the Zoo's giant panda efforts. I am confident our goals will be met. So many people have already expressed a desire to take part in this worldwide conservation effort: from volunteers in our giant panda interpretive program, to individual and corporate donors, to cyber-visitors sending Mei Xiang and Tian Tian warm welcomes through our website.

Every member of Friends of the National Zoo can know that their membership has made a difference—and will continue to make a difference in the years ahead. FONZ is further offering those donating to the Giant Panda Conservation Fund the chance to inscribe a brick in the walkway around the new exhibit's outdoor habitat, cementing their support of pandas for decades to come.

Now that the pandas have gone public, I invite you to come see Mei Xiang and Tian Tian in person. They will inspire you to dream not just of a bright future for their wild cousins in China, but for the future of wildlife and wild places around the world. But we aren't going to stop with our inspiring, new giant pandas. We look forward to working with the Zoo's new director, Lucy Spelman, to create her vision of a new sloth bear exhibit at the Zoo, a renovated Elephant House, and much more.

This is a great moment for the Smithsonian's National Zoo, for FONZ, and for everyone who loves giant pandas. Thanks for your integral role as a FONZ member in making this day possible!

Sincerely,

Clinton A. Fields
Executive Director

Friends of the National Zoo would like to thank Fujifilm, Discovery Communication's Animal Planet, and FedEx Express for their generous financial and in-kind support of the National Zoo's giant panda program.

Friends of the National Zoo is a nonprofit organization of individuals, families, and organizations who are interested in helping to maintain the status of the Smithsonian's National Zoological Park as one of the world's great zoos, to foster its use for education, research, and recreation, to increase and improve its facilities and collections, and to advance the welfare of its animals.

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Smithsonian ***National Zoological Park*** is located at 3001 Connecticut Ave., N.W., Washington, DC 20008-2537. Weather permitting, the Zoo is open every day except December 25. Hours: From May 1 to September 15, grounds are open from 6 a.m. to 8 p.m.; buildings, 10 a.m. to 6 p.m. From September 16 to April 30, grounds are open from 6 a.m. to 6 p.m.; buildings, 10 a.m. to 4:30 p.m.

Membership in FONZ offers many benefits: publications, discounts on shopping, programs, and events, free parking, and invitations to special programs and activities to make zoogoing more enjoyable and educational. To join, write FONZ Membership, National Zoological Park, Washington, DC 20008, call 202.673.4961 or go to www.fonz.org.

Membership categories and annual tax-deductible dues are:

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Cover photo: Mei Xiang and Tian Tian tussling together. Photo by Windland Rice.

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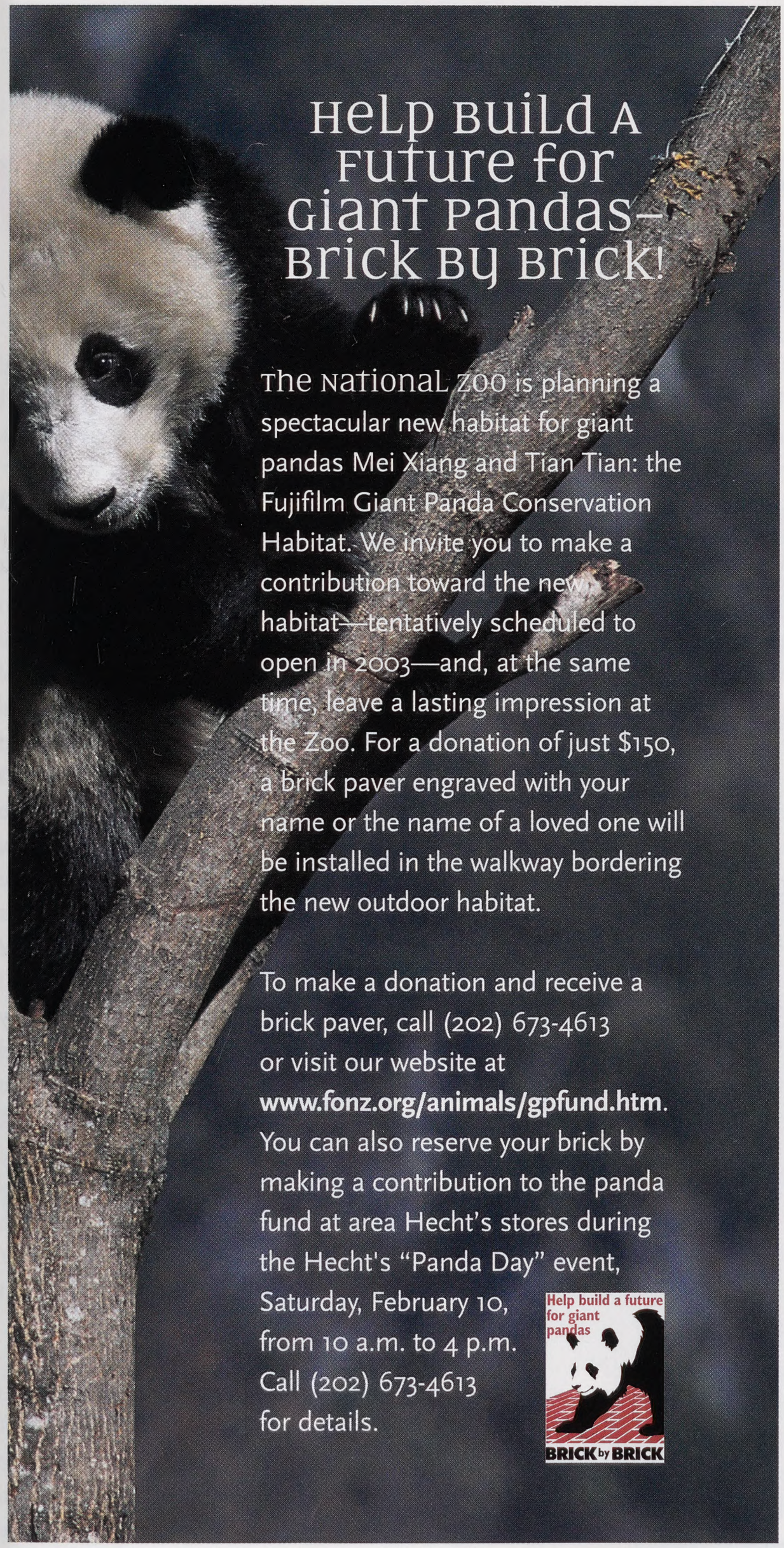

Help build a future for giant pandas—brick by brick!

The National Zoo is planning a spectacular new habitat for giant pandas Mei Xiang and Tian Tian: the Fujifilm Giant Panda Conservation Habitat. We invite you to make a contribution toward the new habitat—tentatively scheduled to open in 2003—and, at the same time, leave a lasting impression at the Zoo. For a donation of just $150, a brick paver engraved with your name or the name of a loved one will be installed in the walkway bordering the new outdoor habitat.

To make a donation and receive a brick paver, call (202) 673-4613 or visit our website at **www.fonz.org/animals/gpfund.htm**. You can also reserve your brick by making a contribution to the panda fund at area Hecht's stores during the Hecht's "Panda Day" event, Saturday, February 10, from 10 a.m. to 4 p.m. Call (202) 673-4613 for details.

Help build a future for giant pandas
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NOTES & NEWS

ANIMAL NEWS

Zoogoers can expect the pitter-patter of little giraffe and elephant feet in the coming year. At the time of publication, Griff, our 18-year-old Masai giraffe (*Giraffa camelopardalis tippelskirchi*—its species name deriving from the ancient Roman belief that the strangely proportioned animal was a hybrid of camel and leopard) was nearing the end of a 15-month gestation period, with a delivery expected in early January 2001. Griff's baby will be her sixth offspring, but the first sired by Ryma, the Zoo's 15-year-old male.

GRIFF HAS ALREADY REARED FIVE OFFSPRING.

In the wild, female giraffes give birth in traditional calving grounds. For reasons yet unknown, expecting mothers will travel great distances to return to the same site to give birth. At about six feet, newborn giraffes are taller than the average adult person. Even so, wild calves are extremely vulnerable to predators and must grow quickly to survive. Consequently, young giraffes are adapted to grow as much as an inch each day and nearly double their height within their first year.

The giraffes live at the Smithsonian National Zoo's Elephant House alongside other large mammals, including Shanthi, our 24-year-old, 8,300-pound Asian elephant (*Elephas maximus*), who is expecting a calf of her own next December. With no male elephants at the Zoo, Shanthi was impregnated through artificial insemination.

Two female Raggiana birds of paradise (*Paradisaea raggiana*) and one female magnificent bird of paradise (*Diphyllodes magnificus*) are the newest additions to the Zoo's Bird House. The Zoo acquired these exotic birds—both species endemic to New Guinea—on September 20 from the Honolulu Zoo, where they were born. The Zoo expects to receive a male magnificent bird of paradise soon. Fly inside the Bird House to admire these beautiful birds. Also, keep your eye on *ZooGoer* for an upcoming article on pitihouis, another bird group from New Guinea.

MASAI GIRAFFE.

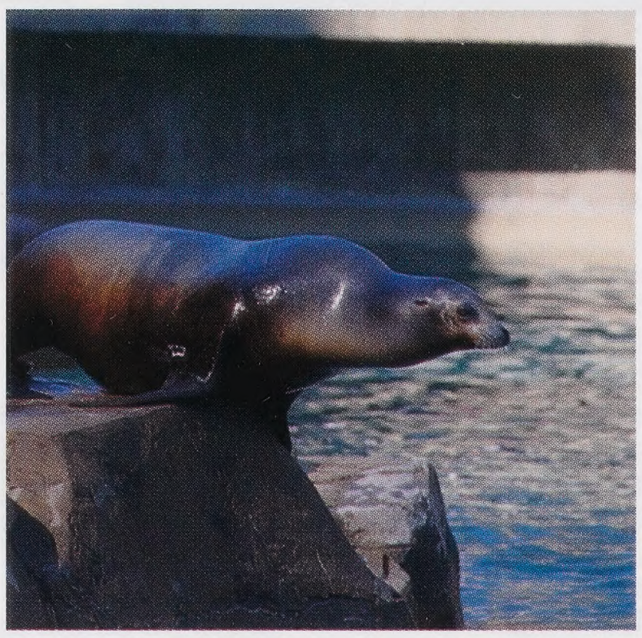
WHO'S ON BOARD?

Following the retirement of Carole A. Valentine, FONZ is pleased to announce that David Perry has been elected President of the FONZ Board of Directors. Since 1985, Mr. Perry has served as Deputy Director of the Federal City Council, a non-profit, non-partisan, business-supported civic organization that works for the betterment of the nation's capital. Board member Lloyd W. Howell, Jr. will replace Mr. Perry as First Vice President.

Six new directors were also elected to the Board: Christopher Capuano, James F. Hinchman, Bernard K. Jarvis, Sue Ruff, Grace Y. Toh, and Eric D. Weiss. Re-elected to the Board were Michele V. Hagans as Secretary, Mark R. Handwerger as Treasurer, Alberta A. "Missy" Kelly as Second Vice President, as well as Thomas B. Arundel, Jeanne Beekhuis, Harold R. Leuba, Suzanne Mink, and Edward A. Sands.

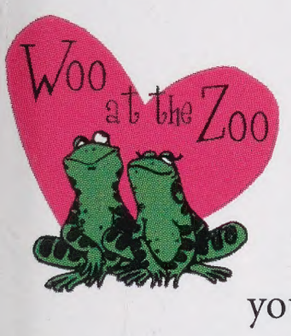
COME SWIM WITH US AT SEAL DAYS

One of the Zoo's most popular special events is approaching—Seal Days. This annual event, which recognizes the International Day of the Seal, celebrates the National Zoo's grey seals and California sea lions, as well as other North American wildlife living in Beaver Valley. Events include hourly animal feedings, training demonstrations, interactive educational displays, talks with animal keepers, and children's crafts and games. And it's free! Seal Days takes place Saturday and Sunday, March 17 and 18, from 11 a.m. to 4 p.m.



CALIFORNIA SEA LION AT THE NATIONAL ZOO.

ALL PHOTOS BY JESSIE COHEN/NZP

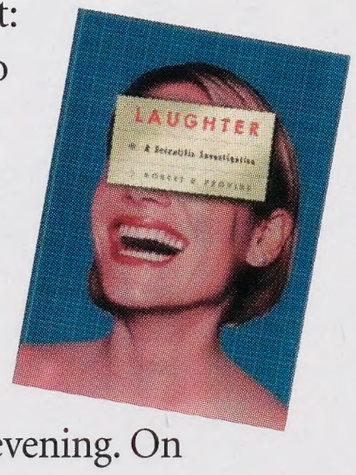


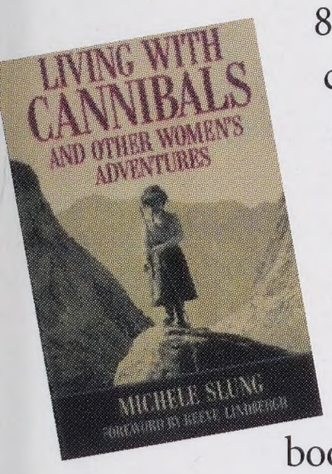
WOO AT THE ZOO

"In the spring a young frog's fancy lightly turns to thoughts of love." Is your valentine tired of flowers and candy? Then treat your special someone to a truly wild evening! Spend a wintry February 14th in the steamy rainforest at the National Zoo's Amazonia exhibit learning about the birds and the bees as National Zoo keeper Ed Smith describes the amorous activities of plants and animals. Afterwards, enjoy a romantic candlelight dinner with your mate in the wild environs of the Amazonia Science Gallery. Make it a date! Woo at the Zoo is on February 14 from 7-9:30 p.m.; the cost is $75 per couple. Call 202.673.4962 with any questions or visit http://www.fonz.org/events/woo.htm for more information.

LECTURES

On Tuesday, February 8, at 8 p.m., Robert Provine, professor of neurobiology and psychology at the University of Maryland, will give a lecture on a funny subject: laughter. Provine will also be available to sign his book *Laughter: A Scientific Investigation*, which discusses the evolution, social role, and physical benefits of this activity we all love, at 7 p.m. that evening. On Wednesday, March 1, at 7:30 p.m., Caroline Dexter of the Archaeological Institute of America will speak about animals in ancient Greek religion, to be followed on Wednesday, March 22, at 8 p.m., by Michele Slung's discussion of women explorers, including animal behavior researchers. Slung is the author of *Living with Cannibals and Other Women's Adventures*, and will sign copies of this book at 7 p.m. Each free lecture takes place in the Zoo's Visitor Center Auditorium. To RSVP, please call 202.673.4801, or visit http://natzoo.si.edu/news/lectures for more information.





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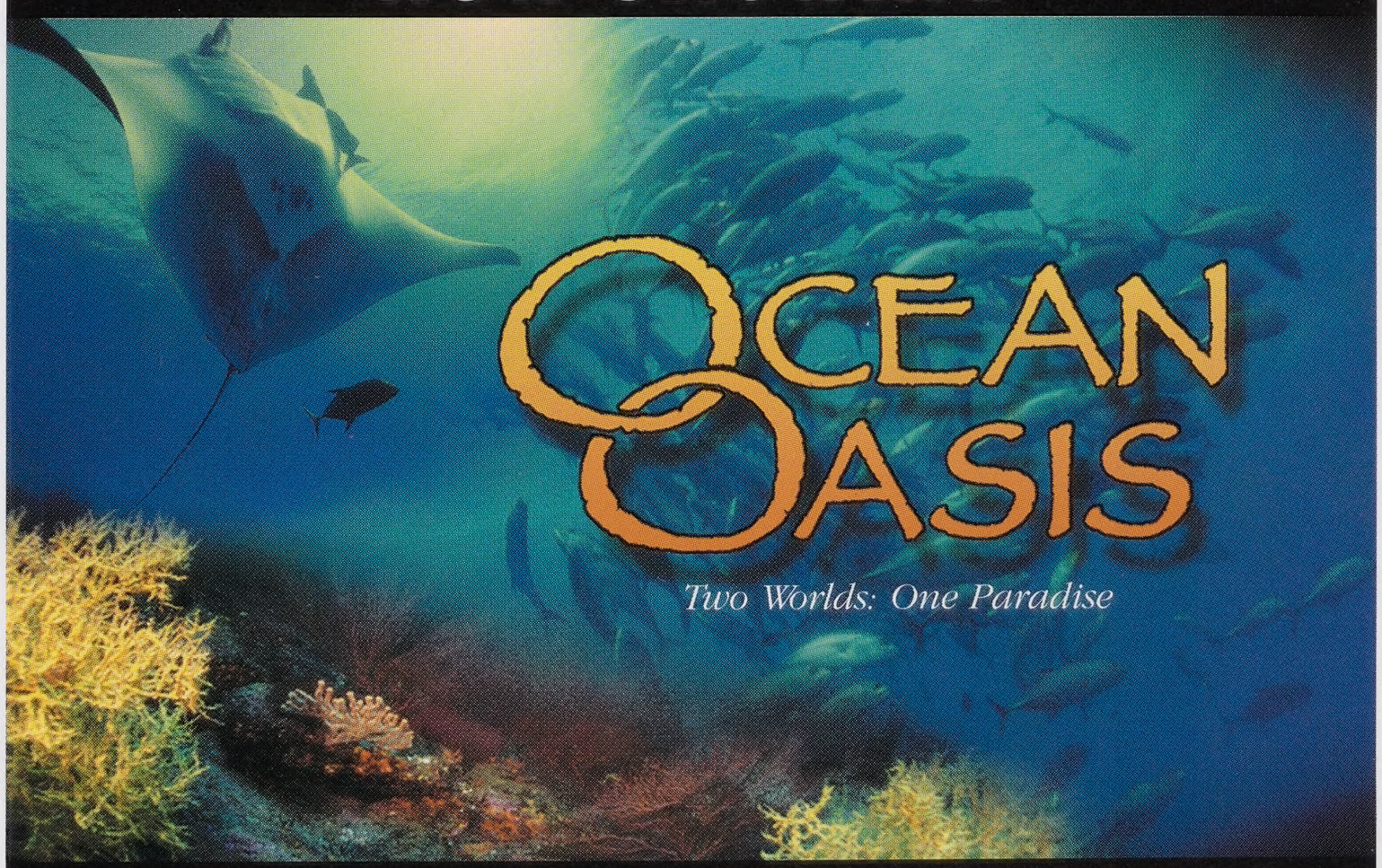

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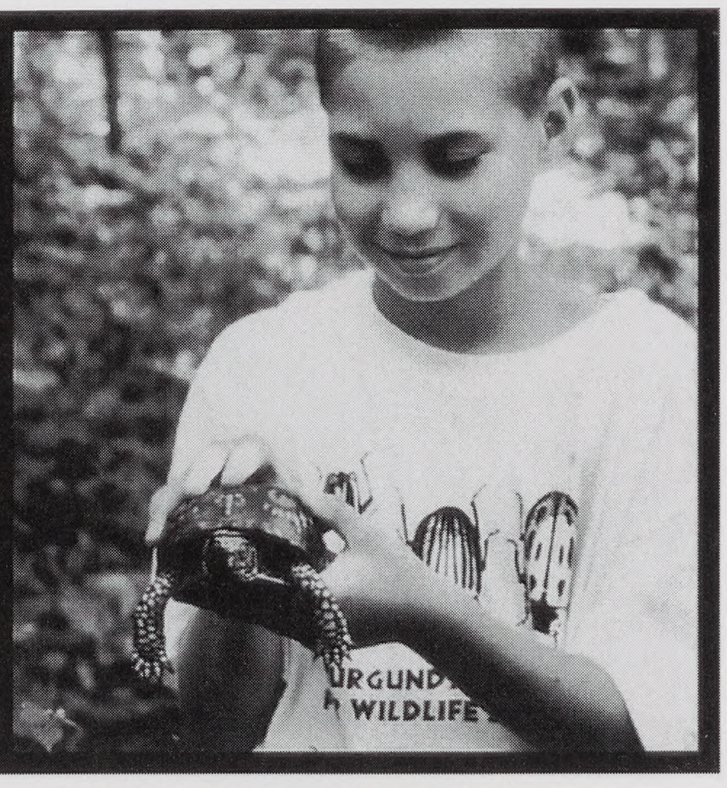


JESSIE COHEN/NZP

TIAN TIAN.

Stud Gia

Save Giant

A Special Report to FO

In conjunction with the loan of giant pandas Tian Tian and Mei Xiang from China, National Zoo scientists have develop training plan related to giant pandas. The research is designed to help ensure that pandas survive in zoos and in the wi

It seems the whole world wants a glimpse of the Smithsonian National Zoo's new giant pandas. There is no doubt that Tian Tian and Mei Xiang are enchanting. Both possess the charm and charisma required to fill the job of ambassador for giant pandas in the wild. Blithely unaware of their mission as they cavort in their National Zoo habitat, these beautiful animals are helping us to inspire people with a desire to save giant pandas—and wildlife and wildlands everywhere. But they have another mission as well—and most people who come to visit them are as unaware of it as the pandas are. They are also helping us to learn *how* to save giant pandas. Think of Tian Tian and Mei Xiang as research collaborators.

ying
nt Pandas to
Pandas:
NZ Members

ed a comprehensive ten-year research and d. The following is a summary of the plan.

JESSIE COHEN/NZP

MEI XIANG.

JESSIE COHEN/NZP

TIAN TIAN AND MEI XIANG.

BACKGROUND IMAGE: COURTESY OF THE FREER GALLERY OF ART, SMITHSONIAN INSTITUTION, WASHINGTON, D.C., #S1987.207.3

National Zoo scientists have been studying giant pandas since the first pair—Ling-Ling and Hsing-Hsing—came to the National Zoo in 1972. Yet there remains much to learn. In some research areas, it is important to repeat the observations made on Ling and Hsing. By increasing the sample size, scientists will be able to tell, for instance, whether a behavior pattern is common to giant pandas or peculiar to individuals. In other areas, such as reproductive biology, the advanced techniques scientists are using today largely didn't exist while Ling and Hsing were alive. What's more, the opportunities for research and conservation initiatives in the wild, including the potential for bolstering the wild giant panda population in China through reintroduction, are greater today than at any time in the past.

This points to another role that Tian Tian and Mei Xiang play: that of fundraisers. The National Zoo's ambitious ten-year research plan—a plan that we hope culminates in a growing, thriving population of giant pandas—will be costly to carry out. So will China's official National Plan for the Conservation of Giant Pandas and Their Habitats. The magnetism of our pair has attracted, and will continue to attract, support from donors large and small. This will make saving giant pandas and their habitat possible.

Finally, there now exists a critical mass of collaborators in all areas of giant panda conservation and research: colleagues in China, including at the China Wildlife Conservation Association; China Research and Conservation Center for the Giant Panda; Wolong Nature Reserve; the Chinese Association of Zoological Gardens; the Chinese Academy of Sciences; Beijing University; Beijing Zoo; Chengdu Zoo; and the Chengdu Research and Breeding Base; at the San Diego Zoo and Zoo Atlanta, which also exhibit giant pandas; and at organizations like the U.S. Fish & Wildlife Service, World Wildlife Fund, and the Conservation Breeding Specialist Group of the World Conservation Union.

JESSIE COHEN/NZP

TIAN TIAN AND MEI XIANG MET IN WOLONG BEFORE THEIR TRANSFER TO THE NATIONAL ZOO.

Growing Zoo Pandas

Today's best estimate of giant panda numbers in the wild is about 1,100 individuals living in up to 32 separate populations mostly in China's Sichuan Province, but also in Shaanxi and Gansu provinces. Some of these populations number in the hundreds of animals, others include just a handful. In addition, the world zoo population is less than about 150 individuals, most of which are in China (we use the word zoo here as shorthand to include traditional zoos as well as breeding centers and similar facilities). The zoo giant panda population represents a potential pool of animals for reintroduction. One strategy for saving the remaining total population of giant pandas (zoo and wild) is to view them as one "meta-population" and then develop strategies to link and expand this population. If panda populations cannot be linked geographically through creation of habitat corridors, meta-population management would include linking them through our interventions. For instance, we could move animals among the various populations or inseminate females in one population with semen from males in another, or both.

Despite some successes, giant pandas generally have not bred well in zoos. Thus, a major portion of the National Zoo's research efforts in the next few years will be devoted to evaluating the reproductive competence of giant pandas in zoos as well as in the wild. Techniques to do this must also be developed.

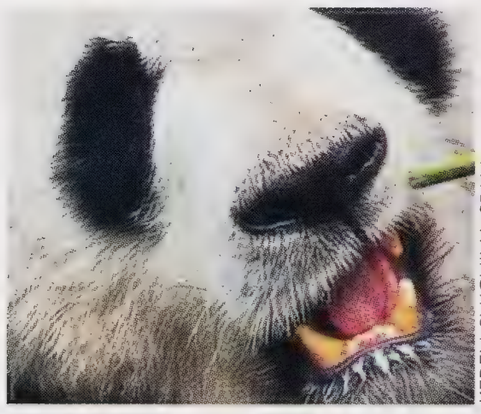
One such technique involves monitoring endocrine, or hormone, function. In particular, measuring gonadal (reproductive) and adrenal (stress) hormone levels reveals much about an animal's reproductive condition and its general well-being. For instance, patterns of change in the levels of various gonadal hormones may indicate the onset of puberty, normal estrous cycling, and pregnancy. Changes in adrenal hormone levels may indicate how much stress an animal is experiencing as a result of, for instance, contact with people or other disturbances in its habitat. Further, adrenal hormones and gonadal hormones may interact so that, for example, stress may alter secretion of gonadal hormones and thus negatively affect reproduction.

Traditionally, patterns of hormone secretion have been measured in urine samples, just as human pregnancy tests involve testing for certain hormones in a woman's urine. National Zoo scientists will be developing the ability to measure hormones in the feces of giant pandas as well. Although National Zoo scientists have been collecting giant panda urine samples for many years, feces are more easily collected (biologists are notoriously unsqueamish) from zoo and wild animals than urine.

National Zoo scientists will use previously developed methods of monitoring hormones in urine and new methods of fecal hormone monitoring to study lifelong changes in endocrine function in Tian Tian and Mei Xiang. Monitoring hormonal changes will help scientists to better understand the reproductive biology of giant pandas. It will also help them determine how reproductive

COURTESY OF THE FREER GALLERY OF ART, SMITHSONIAN INSTITUTION, WASHINGTON, D.C., #F1975.16

BAMBOO ADORNS MANY WORKS OF CHINESE ART, INCLUDING THIS QING DYNASTY FAN FROM THE LATE 19TH CENTURY. THE POEM ALONG THE LEFT SIDE BEGINS, "IN A BAMBOO GROVE A MAIDEN FINDS HER SOLITARY HEART...."



KEREN SU/CHINA SPAN

GIANT PANDA TEETH ARE ADAPTED TO CHEWING BAMBOO.

ALEX HAWES/FONZ

JESSIE COHEN/NZP

NATIONAL ZOO RESEARCHER OBSERVES MEI XIANG AND TIAN TIAN AT WOLONG.

performance and animal well-being are influenced by the social system; by restraint, anesthesia, and translocation practices; and by pre-release conditioning and reintroduction. The impact of human disturbance or other environmental perturbations on animal well-being can also be assessed.

Another study designed to enhance zoo reproduction will focus on the relationships between reproductive success and each of the following: behavioral traits and temperament of individual giant pandas, husbandry practices such as enclosure size and diet, and physiological stress. National Zoo scientists will use data on these variables from giant pandas in several breeding facilities in China as well as from our own pandas and those at other non-Chinese zoos. Based on the results, they will suggest interventions that might improve giant panda breeding. For example, National Zoo scientists hypothesize that a diet of mostly bamboo, rather than concentrated foods, enhances reproductive success. If this prediction is supported by the data, then diet changes will be recommended at those facilities that feed their pandas concentrated foods. Follow-up studies will then test whether the diet change or other intervention does in fact make a difference to breeding performance.

Even when natural breeding success improves in zoo giant pandas, there will be a need for assisted reproduction, such as artificial insemination, to ensure that all possible males, even those unwilling to breed naturally, contribute genes to the next generation. (Only a few zoo males have ever fathered young through natural mating.) Moreover, preserving sperm, eggs, and other tissue in what some call a "frozen zoo" (and scientists call "a genome resource bank") will provide an insurance policy against a catastrophic decline in giant panda numbers. But there is an urgent need to learn much more about the details of gamete (sperm) physiology, as most work has been done on females. Thus, National Zoo scientists plan to focus initially on whether inbreeding or other factors affects sperm quality. Further, our scientists plan to collaborate with Chinese colleagues to test and improve techniques for freezing and thawing giant panda sperm. This will increase the success of artificial insemination and allow us to be confident that stored frozen sperm will maintain its viability over the long term. National Zoo scientists also plan to work with Chinese colleagues and funding agencies to develop an organized strategy for genome resources banking and to build one or two repositories in China.

Overcoming the problems giant pandas have mating successfully in zoos is an important first step. However, zoo pandas also seem to suffer from high levels of infant mortality. For instance, all five cubs born at the National Zoo died of bacterial infections within a few days of birth. National Zoo scientists also discovered that cubs in zoos in Madrid, Mexico City, and China similarly died of bacterial infection. This tells pathologists that the cubs aren't receiving sufficient antibodies from their mothers to fight off infections caused by bacteria encountered during birth. As in many other species, newborn pandas receive maternal antibodies in colostrum, the milk a mother briefly secretes after parturition. The time during which the infant can absorb these antibodies is related to how long they persist in the mother's milk. So, if the baby fails to nurse promptly, or the mother fails to offer proper and prompt maternal care, the baby loses the immunity the mother's antibodies would have provided.

In domestic animals, such as horses, scientists have been able to extract antibodies from adults and prepare them to be given to foals either by injection or orally. National Zoo scientists plan to replicate this technology for use in giant pandas. This will increase infant survival, especially of babies that are rejected by their mothers (a common occurrence when twins are born) and must be hand-reared.

Another problem that arises in young zoo panda infants, especially those separated early from their mothers for hand-rearing or for other reasons, is stunted growth that may lead to disease or death. Studying giant panda lactation and milk composition, an area in which National Zoo scientists are leaders, will help to formulate

Today's best estimate of giant panda numbers in the wild is about 1,100 individuals living in up to 32 separate populations mostly in China's Sichuan Province.

appropriate diets for hand-reared pandas, thus enhancing their survival rates and increasing the zoo population.

Beyond Zoos

Increasing the number of giant pandas in zoos to create a self-sustaining population will offer an insurance policy against the species' extinction in the wild. But the overarching goal is to ensure that the policy never has to pay out. One strategy to save giant pandas in the wild is reintroduction, although this will require achieving other interim goals, including the growth of the zoo population described above. Several aspects of the National Zoo's research plan address the other requirements for eventual reintroduction, should that become necessary.

National Zoo scientists are steadily gaining experience in reintroducing zoo animals to natural habitats, most prominently through the successful golden lion tamarin reintroduction program that the National Zoo has conducted since 1984. In some species, such as black-footed ferrets, the way animals are released influences the survival rates of the introduced animals. Slow, careful preparation and training before release, and food and shelter support for some time after release—dubbed a "soft release" —may result in greater survival than a "hard release," which is the equivalent of going cold turkey. Tian Tian's and Mei Xiang's presence at the National Zoo will allow our scientists to determine what preparation, training, and support giant pandas might need to minimize mortality after reintroduction.

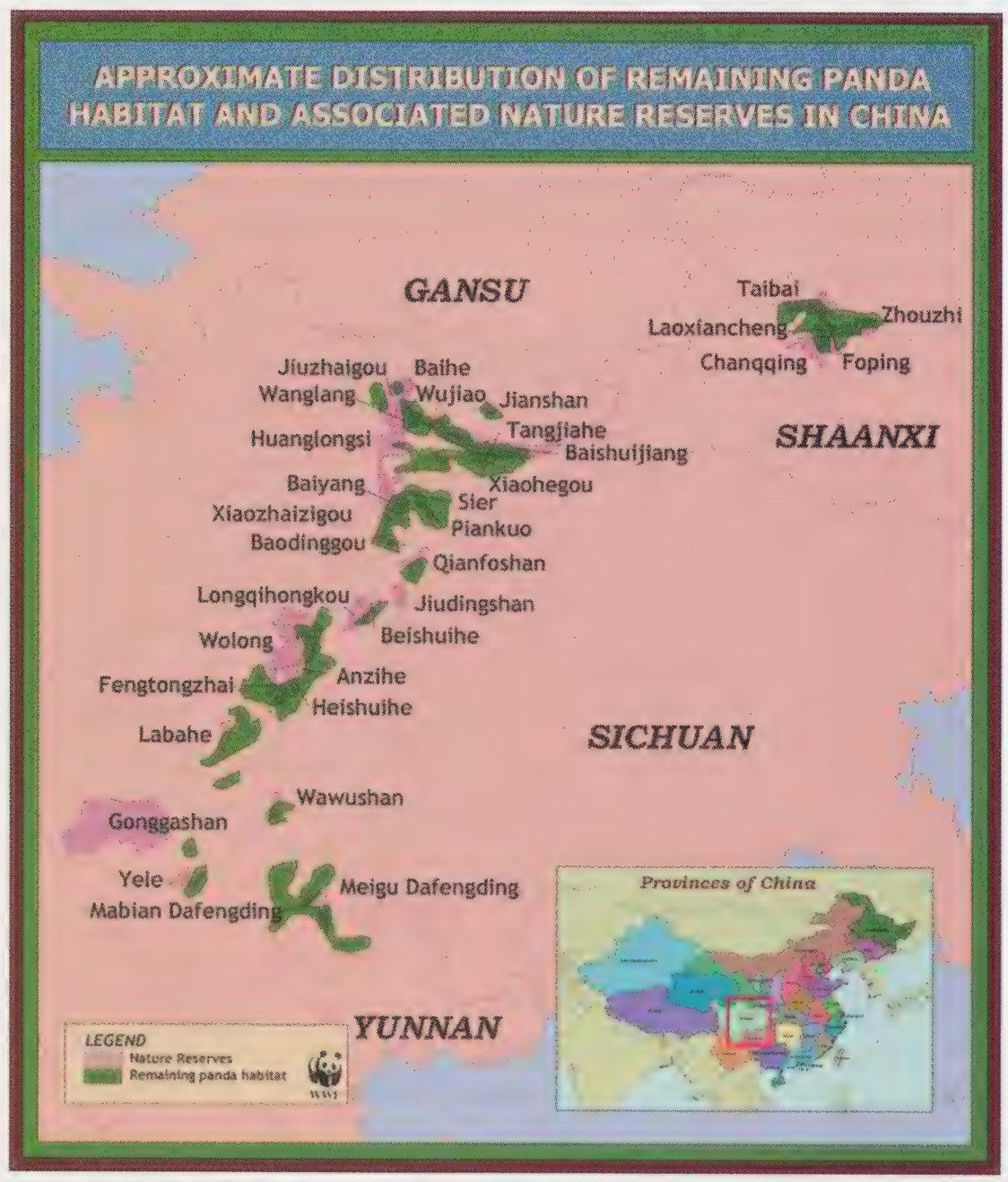
For instance, we will need to know about giant panda preferences for eating various species of bamboo. If we learn that giant pandas prefer to eat the bamboo species they were first exposed to in zoos, we will have to be sure to include in their zoo diet the species they are most likely to find in the reintroduction site. Similarly, we will test whether giant pandas instinctively recognize and avoid predators, such as leopards; if they do not, we can devise ways to train them to do so. While there is no reason to reintroduce giant pandas at this time, all of this research will set the stage for a reintroduction program if needed in the future and will offer insight to our Chinese colleagues as they decide whether, when, and where to reintroduce giant pandas in the wild.

Another set of wide-ranging studies will examine the environmental and social preferences of our giant pandas as they mature. For instance, we will examine whether our pandas prefer to be indoors or outdoors at various times of the day and year; what kind of trees pandas prefer to climb in (and what kind of trees can survive the wear and tear); and the influence of visitors on the animals' behavior. This and other information will ensure that our giant pandas live in the best possible zoo environment. At the same time, extensive observation of our giant pandas will let us document the

TRAINING CONSERVATIONISTS

The future of giant pandas, like the future of all wildlife and wild lands in China, depends upon the continued development of a cadre of Chinese conservation biologists and leaders. These people will carry out their country's conservation policies and inspire conservation actions and initiatives at local, provincial, and national levels. Without such dedicated, well-trained individuals in China, conservation will fail.

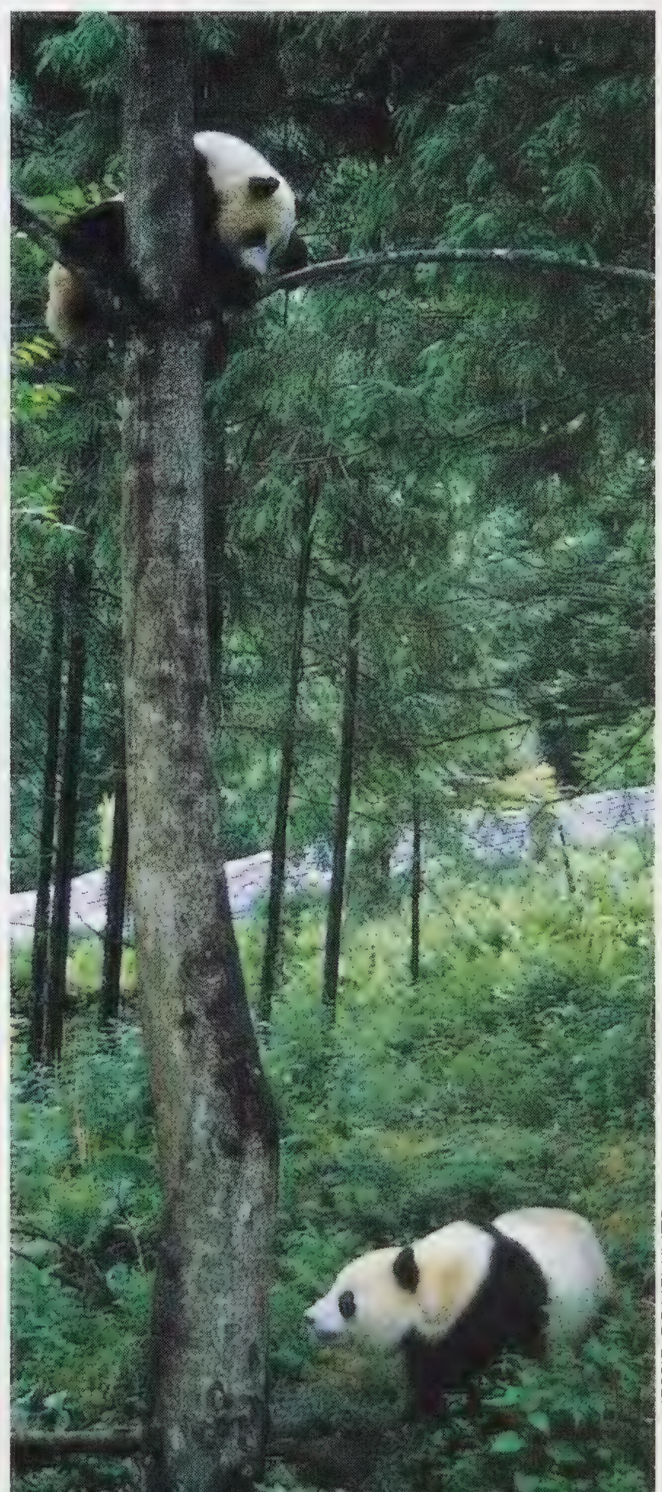
Helping to build China's capacity for conservation—the ability of individuals and organizations to conduct the programs needed to save giant pandas and their habitat—is one of the most significant contributions the Smithsonian's National Zoological Park can make. In the next year we plan to offer the Conservation Biology and Wildlife Management training program to the personnel of three giant panda reserves in China: Qianfoshan Reserve, Yele Reserve, and Meigu-Dafengding Reserve [see map, right]. These reserves were selected to receive part of our contribution to giant panda conservation in China. They are poorly developed and need attention at every level, from training for staff to building guard stations and posting boundaries. A priority will be surveying and monitoring in the three reserves to assess the current status of wildlife and then track how it is faring in the years to come. The people who will do this are the reserve staff: men and women at the front lines of the battle to save wildlife. The training we provide could help determine whether they win or lose.



development of their social and reproductive behavior, such as scent-marking, play, vocalizations, and courtship, and compare their development to that of Ling-Ling and Hsing-Hsing.

Part of creating the best possible circumstances for Tian Tian and Mei Xiang will be offering them preventive veterinary medical care, such as regular health exams, immunizations against disease, infectious disease screening, and imaging of internal organs. Such treatment offers two additional benefits. First, we can establish "normal" values for various medical aspects of giant pandas, addressing the problem of not knowing whether, for example, what we see in an ultrasound image of a kidney indicates health or disease. Amazingly, only one text book reports the normal anatomy of giant pandas, and this is based on a single necropsy (the animal equivalent of an autopsy). Our comprehensive veterinary medicine program will thus significantly advance understanding of how to care for giant pandas.

A key component of health is adequate nutrition, and for giant pandas that means getting all they need from bamboo. But does bamboo contain all the nutrients, in the proper amounts, that a panda needs for health, growth, and reproduction? Our scientists plan to answer this question by determining the nutritional composition of various species of bamboo and, further, how this might differ seasonally, in different locations, and among the parts of the bamboo (such as shoots, new leaves, and old leaves). Of particular interest is selenium, an essential dietary trace mineral for the good health of people, livestock, and, presumably, all mammals. The soil in parts of China where giant pandas live is known to be selenium deficient, which may mean that the bamboo they eat isn't providing enough of this mineral. We will also look for correlations between nutritional composition of different bamboo species, and the pandas' preferences, to see if pandas eat "what is good for them."



JESSIE COHEN/NZP

MEI AND TIAN IN WOLONG.

JESSIE COHEN/NZP

ZOO RESEARCH WILL EXAMINE THE PANDAS' USE OF THEIR NEW ZOO EXHIBIT.

At the same time, our scientists and veterinarians will continue their collaboration in a long-term project to evaluate the health and the reproductive and genetic status of all of the giant pandas in zoos and breeding facilities in China.

As we work to bolster the zoo panda population, we can't ignore the giant pandas and their habitat in the wild. Now and in the future, we need accurate and current information on the numbers, habitat needs, and range of pandas. Our focus will be in the Tangjiahe Reserve and, more broadly, the Min Mountains of western China, where we will map land use and critical habitat and conduct an ecological assessment of available panda habitat. In addition, we will develop techniques, such as satellite tracking, for monitoring the numbers and movements of wild giant pandas. One exciting plan is to perfect a procedure to determine the individual identities and sexes of giant pandas, without having to capture the animals, by analyzing DNA extracted from feces and hair samples. At the same time, we plan to expand the scope of monitoring to include the other species that share the giant panda's habitat [see "Under the Giant Panda's Umbrella," page 24].

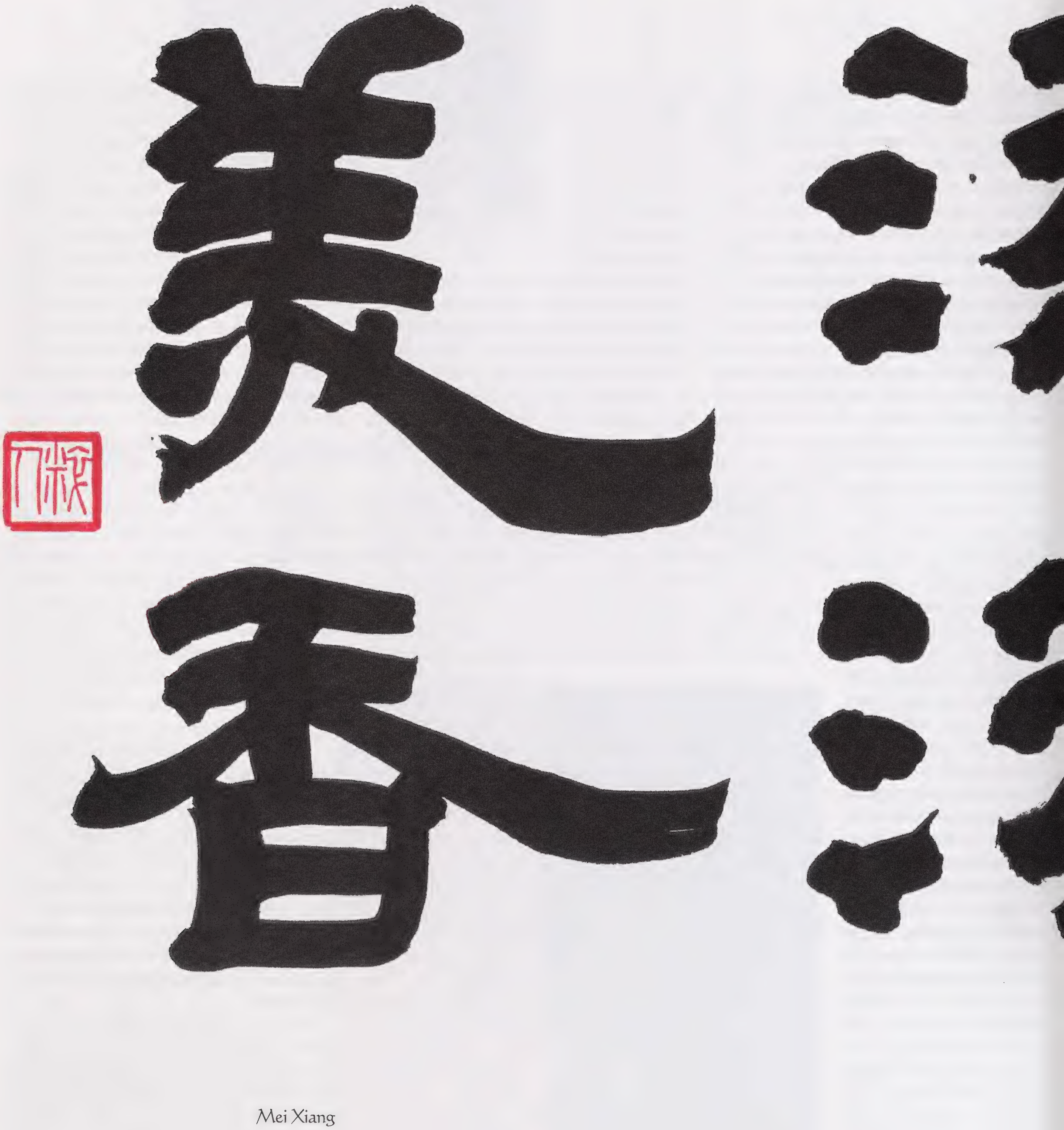
Supporting Roles

One of the most important roles we can play in giant panda conservation is sharing expertise with Chinese scientists and conservationists, and training Chinese students, field biologists, veterinarians, and wildlife managers in the most advanced conservation techniques and practices [see box, page 12]. An integral part of our research program will be including Chinese students and counterparts as partners, and rapidly sharing new information with Chinese colleagues. This is a tradition of National Zoo scientists working in other parts of the world, as is providing short-term training programs in areas from wildlife management to zoo biology and environmental leadership.

We also plan to assist efforts to inspire Chinese citizens to participate in efforts to save their country's pandas, just as we are inspiring everyone who visits Tian Tian and Mei Xiang to want to do so as well. We know that science alone will not be enough to ensure that giant pandas survive in the wild well into the future. Without the support of those most intimately involved—the people who live near giant panda habitat whose needs must be met too—our efforts ultimately will not succeed.

The funds transferred to China to secure the loan of Tian Tian and Mei Xiang represent another important supporting role the National Zoo plays. This money, some $1 million a year for ten years, will be crucial to China's implementation of giant panda conservation. For instance, in the first three years of the program, three important but currently under-funded Chinese giant panda reserves in Sichuan will be able to significantly upgrade facilities, education programs, and panda protection and monitoring activities.

Tian Tian and Mei Xiang will grow up in the months and years ahead, and, we hope, produce giant panda babies, adding to their resumes the job of prolific parents—as if ambassador, research assistant, fundraiser, and star weren't enough. But then, this is Washington, D.C., where conservation leaders wear many hats as they strive to improve the outlook for the future of the natural world. Z



Mei Xiang

CALLIGRAPHY BY JOHN S.C. WANG

Tian Tian

CHINESE CALLIGRAPHY DEPICTS *MEI XIANG* [LEFT]—MEANING "BEAUTIFUL FRAGRANCE"—AND *TIAN TIAN* [RIGHT], MEANING "MORE AND MORE."

Mei Xiang and Tian Tian Arrive!

"Dig deep enough and you'll hit China," promise American parents to eager children at the beach. Fortunately, an army of plastic-shovel-wielding preschoolers wasn't required to clear a path for Mei Xiang and Tian Tian—a Fed Ex MD-11 cargo jet hastened the furry duo from their native turf in central China's Sichuan Province halfway around the world to the Smithsonian's National Zoo in Washington, D.C. The photographs on pages 16-17 by National Zoo photographers Jessie Cohen and Leah Overstreet, Fujifilm photographer Windland Rice, and Smithsonian photographer Jeff Tinsley, celebrate the historic transfer of the Zoo's newest residents.

The long day's journey began at the China Research and Conservation Center for the Giant Panda in Wolong, 80 miles northwest of Sichuan's capital city, Chengdu. Both Tian Tian and Mei Xiang were born at the research center, which currently boasts about 40 giant pandas, while an estimated 100 wild pandas roam the surrounding 770-square-mile Wolong Nature Reserve. Before the transfer, National Zoo staff had spent several days at Wolong familiarizing themselves with Mei Xiang's and Tian Tian's care and testing their preferences for different food items.

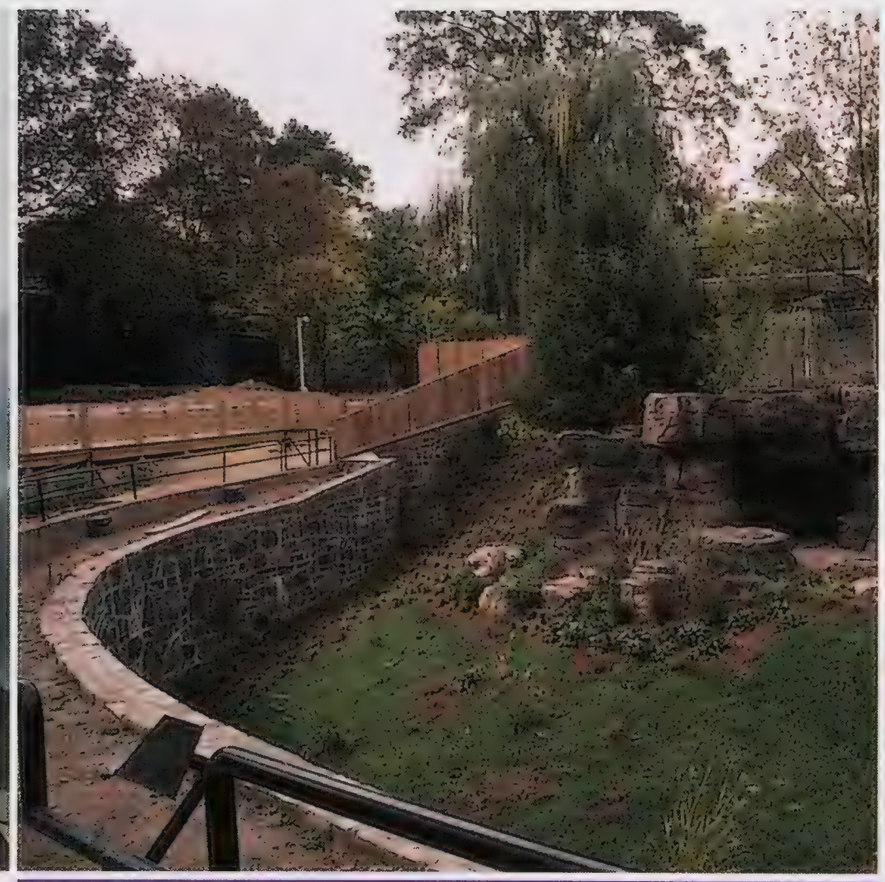
Early in the morning of December 6—following a formal hand-over ceremony the previous afternoon—Mei Xiang and Tian Tian were loaded into custom-built containers bound for the Chengdu airport. Under wintry gray skies, a truck carrying the pandas winded through fields of wheat and rice before reaching the industrialized terrain of the capital city. (The convoy attracted nearly as much local media attention as that Ryder truck full of ballots bound for Tallahassee.)

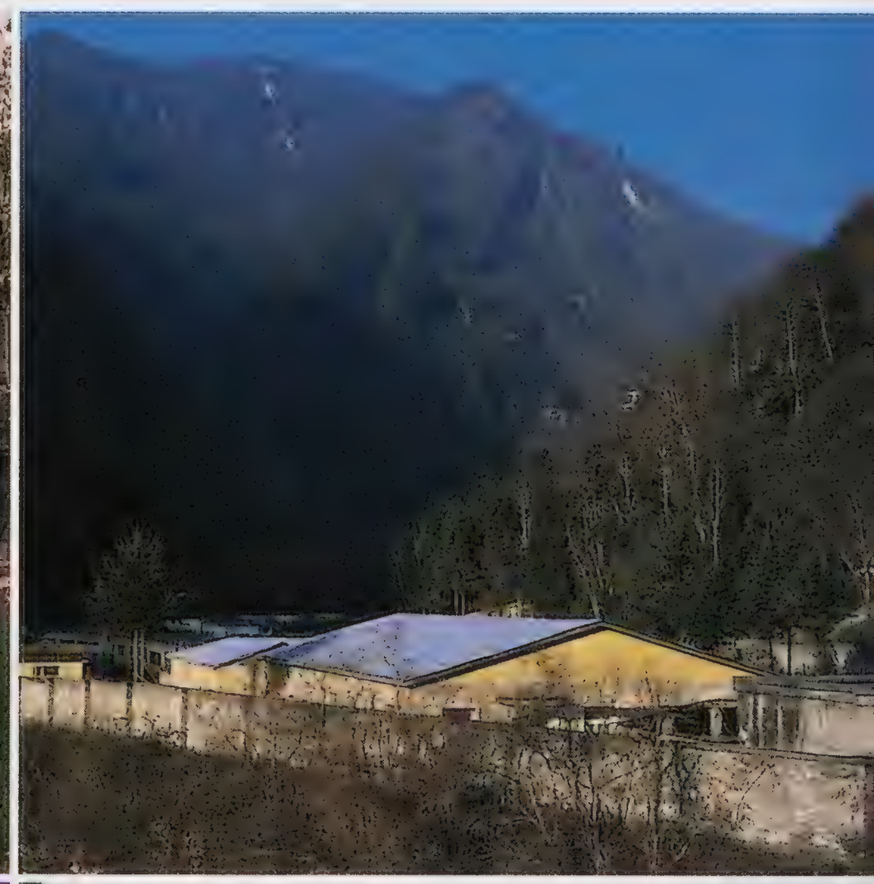
Taking off from Chengdu at 10:58 a.m., on a plane dubbed PandaOne, the crew crossed the international date line and arrived in Anchorage, Alaska, to refuel and clear customs at 7:23 a.m. (still December 6), before heading onwards to Washington, D.C. During the 17 hours aboard PandaOne, Mei Xiang and Tian Tian—seemingly unfazed by the whole hullabaloo—napped and snacked under the supervision of both National Zoo and Wolong staff.

Once the plane touched down at Dulles International Airport shortly after 3 p.m., the pandas were trucked special delivery to the National Zoo, arriving at 4:55 p.m. to a blustery chill not much different from the conditions they left behind in Wolong. Mei Xiang and Tian Tian tentatively explored the renovated Panda House before promptly consuming the 100 pounds of bamboo laid out for them inside—not to mention the ornamental bamboo tastefully arranged in an exhibit planter.

One small step for the National Zoo, one giant panda leap for conservation. Z

—Alex Hawes





MIDDLE ROW, FROM LEFT: SEALING THE DEAL (JC); ON THE ROAD TO CHENGDU (JC); THE FEDEX EXPRESS PANDA LOGO (WR); THE PANDAONE AIRPLANE (JC); ONE OF THE TWO CUSTOM-BUILT TRANSPORT CRATES (WR).

To follow Mei Xiang and Tian Tian's new life at the National Zoo, and to learn all about giant

Top row, from left: Renovating the Giant Panda House in anticipation of Mei Xiang and Tian Tian's arrival (Jessie Cohen/NZP); their new outdoor habitat, with air-conditioned grotto (Leah Overstreet/NZP); Wolong Nature Reserve, China (Windland Rice); Chinese officials preside over the official hand-over (JC); Mei Xiang and Tian Tian at Wolong (JC).

Bottom row, from left: Zoo staff in flight from China (WR); PandaOne touches down at Dulles (LO); entering the Zoo's Panda House for the first time (Jeff Tinsley/SI); Tian Tian peers at a Zoo panda keeper (JC); Tian Tian and Mei Xiang quickly made themselves feel right at home (JC).

panda biology and conservation, check out the Zoo's new panda website at: http://pandas.si.edu.

Panda Under 英 a 命 Pear Tree

It surprised us that the giant panda standing under a pear tree seemed small—smaller than Ling-Ling or Hsing-Hsing, the individuals that so shaped our mental image of giant pandas. Just minutes before we arrived, the young female panda had been sitting under the pear tree eating a pear. Now, we were 30 feet away when the panda turned, walked a few feet to a low stone wall, climbed

BY JOHN SEIDENSTICKER
AND SUSAN LUMPKIN

COURTESY OF THE FREER GALLERY OF ART, SMITHSONIAN INSTITUTION, WASHINGTON, D.C. #F1993.4

THIS MING DYNASTY INK-ON-SILK HANDSCROLL (CIRCA 1500 A.D.) DEPICTS "EMPEROR MINGHUANG'S JOURNEY TO SICHUAN."

effortlessly over it, and disappeared among the rumpled, spent corn stalks, soggy with early November morning dew. John followed, keeping about 30 feet away, as the panda ambled through the seven-foot-tall corn stalks clinging to this steep slope deep in the Min Shan, in a place called Pingwu County, about 150 miles north of Chengdu in China's Sichuan Province.

The panda slipped in and out of view as John climbed up through the cornfield. Each corn stalk grew in its own soil-filled, rocked-up micro-terrace. This is very labor-intensive agriculture but it has sustained mountain farmers here for generations. The panda could maintain its effortless, robust, rolling gait for hours; and John was certain he couldn't match the panda's pace on this slope for long. But then, after about150 yards, the cornfield ended, and following became impossible. Emerging from the field, the panda climbed a steep, 15-foot slope face, and retreated into thick brush. There was no tracking the animal through that tangle.

The Min Shan (*shan* means mountain) are the core of panda country. About half of the remaining wild giant pandas inhabit this range of towering ridges and deep valleys. So do many people: About 183,000 live in remote Pingwu County, mostly on small farms.

The pear tree where we first saw the panda grew between the cornfield, a vegetable garden bright with ripe red peppers, and a small, two-story barn with a goat stall on the lower story. The barn, a long low-slung house, and a few other tidy outbuildings delicately placed among giant boulders were perched on a terrace overlooking a narrow gorge. The gorge with its clear, rapid stream would be spectacular in any setting, but here it was miniaturized by the towering slopes, in the way of a classic artistic rendering of a Chinese mountainscape. We had cautiously crossed a single-log bridge that spanned the gorge to reach this farm site, leaving our vehicles partly obscured by brush on the narrow track carved into the slope opposite. (Turning them around to head back down the canyon proved interesting, so to speak.)

We were traveling with Ginette Hemley and Peter Debrine of the World Wildlife Fund U.S., as guests of Lu Zhi of the WWF-China Program and the Sichuan Forestry Department. Lu Zhi had been a student affiliated with the National Zoo a few years ago; now she is one of China's conservation leaders.

Our encounter with a wild giant panda came about when our hosts were notified of a potential panda problem and went to investigate. A meeting between the forest department officers, Lu Zhi, and the farmers was in progress when the rest of us gave up hopes of another glimpse of the panda and gathered in the farmyard. The farmers, small men and women dressed in clothing that signaled their Tibetan origins, were explaining just how a panda came to be under their pear tree. The young female, as it turns out, had spent the night with 30 or so goats in the goat stall under the barn. She had been herded into the stall inadvertently the evening before, when she mingled with the goats being put up for the night. In the course of the night, the farmers had heard a loud disturbance in the goat stall but had been reluctant to venture out to find out what the goats' problem was. It wasn't until morning that they opened the stall to release the goats.

JOHN SEIDENSTICKER

NEIGHBORS LOOK ON AS FARMERS DISCUSS WHAT TO DO ABOUT THE GIANT PANDA KILLING THEIR GOATS.

And to their surprise the panda also emerged from the stall. The goats went off to pasture, but the panda remained behind to eat some pears. And the farmers found two dead goats and one badly injured kid left behind. Lu Zhi was amazed; she knew of only two reports of pandas killing goats.

The farmers had lined up the victims on a large boulder, as the evidence of their loss in the negotiation that was taking place. The goats had not been eaten. The injured kid had blood only on one front leg. There didn't seem to be any puncture wounds on one goat; the other had puncture wounds on its neck and back. The issues on the table were compensation for their lost livestock and what to do if the panda returned. It was decided that the farmers would be compensated and Lu Zhi would have her Panda Team of students from Beijing University fly today to Chengdu and drive to this farmstead to monitor the panda's activity should it return. (Even in these remote mountains, Lu Zhi made these arrangement on her cell phone.) The students and forestry officials would wait to see if the panda returned and if she did, capture and move her to the Wanglang Nature Reserve, which was our destination too. We learned later that she did return that night and was reported to have killed nine more goats for a total of 11 dead and one injured; she was captured, and released in the Wanglang Reserve. In the past this young, dispersing female panda may have been rescued and taken to a breeding center, but now she might become a member of the core wild breeding population within the reserve.

These actions are all part of an emerging, enlightened approach to securing a future for giant pandas in the wild. Conservationists are increasingly talking about the 4-Cs formula: For large Carnivores to have a future, there must be Core protected areas in the form of reserves; habitat Corridors connecting the core areas; and the participation and support of human Communities that affect and are affected by the cores and connecting corridors.

Here in China, conservationists and government officials are working to establish trust among themselves and with the local people most affected by the day-to-day activities of giant pandas. The prompt action by a team of students and wildlife officials shows an increase in the resources, tools, knowledge, and cooperation needed to implement conservation action. There is an increased awareness, based on our expanding understanding of panda behavioral and ecological needs, among Chinese wildlife officials about what wild pandas need to survive and how natural panda dispersal corridors in the Min Shan are disrupted by human activities. The new conservation action paradigm also recognizes that incentive payments for local people are a key to long-term success.

Lu Zhi told us she had a number of records of young female pandas dispersing from their natal areas. The farm "our" giant panda visited lies right in a panda dispersal pathway. Undoubtedly, other pandas will come this way in the future. What will motivate these farmers to contact authorities again if they are not satisfied with the outcome this time? Just and rapid compensation for lost resources seems a minimal incentive, but one that is often lacking when conservationists are seeking common ground with local people. A future program may include incentive payments for farmers to maintain these habitat connections, just as we in the United States might take tracks of land out of production and place them in long-term "soil banks" under Department of Agriculture programs. Increasingly, conservation planners are recognizing that stabilizing and sustaining what we are calling middle landscapes—the key habitat connections between the core reserves—is of primary importance to both local communities and to the future of endangered wild giant pandas.

MUCH OF THE

Pandas and Priorities

Where did the young female panda eating pears on a hillside farm operated by Tibetans—and a leper colony, we were to learn—deep in the Min Mountains of Pingwu County on the

JOHN SEIDENSTICKER

ALONG WITH CORN AND PEPPER, MANY FARMHOUSES SPORT SATELLITE DISHES.

northern rim of the Sichuan Basin come from? One possibility is that she climbed over the ridge from the Tangjiahe Reserve (one of the reserves where the Smithsonian's National Zoological Park conservation biologists plan to focus their efforts) in the next county. Or, she might also have come from other forest areas in Pingwu County. The 1998 trial panda survey, organized by the Sichuan Forestry Department and WWF-China, found about 230 giant pandas living in 1,058 square miles of forest in Pingwu County, but only about 30 percent of them live in the county's three core panda reserves. Interestingly, the survey discovered that the remaining 70 percent live in other forest tracts stretching along the high mountain slopes of the county. (Compared to the results of surveys conducted in the 1980s, the number of pandas in the county seems to have remained about the same, but the animals seem to have moved to higher elevations and are more concentrated in the reserves because of disturbances related to logging.) These reserves and forests are home to wild giant pandas. They are where China's national priorities and the giant panda's basic needs intersect in a way that can define the future for wild giant pandas.

Pingwu County includes the very upper watershed of the Fu Chiang, a major tributary of the Chang Jiang, better known to Westerners as the Yangtze River. There has been ongoing logging in old-growth spruce, fir, and pine forests, mostly located in these upper watershed areas, to keep pace with China's need for softwoods, which are in very short supply. So while overall forest cover has increased in China during the last half century to about 14 percent of the land area, logging has remained a major threat in what is left of giant panda habitat and to the giant pandas themselves.

GINETTE HEMLEY/WWF-U.S.

PINGWU'S PROBLEMATIC PANDA.

JOHN SEIDENSTICKER

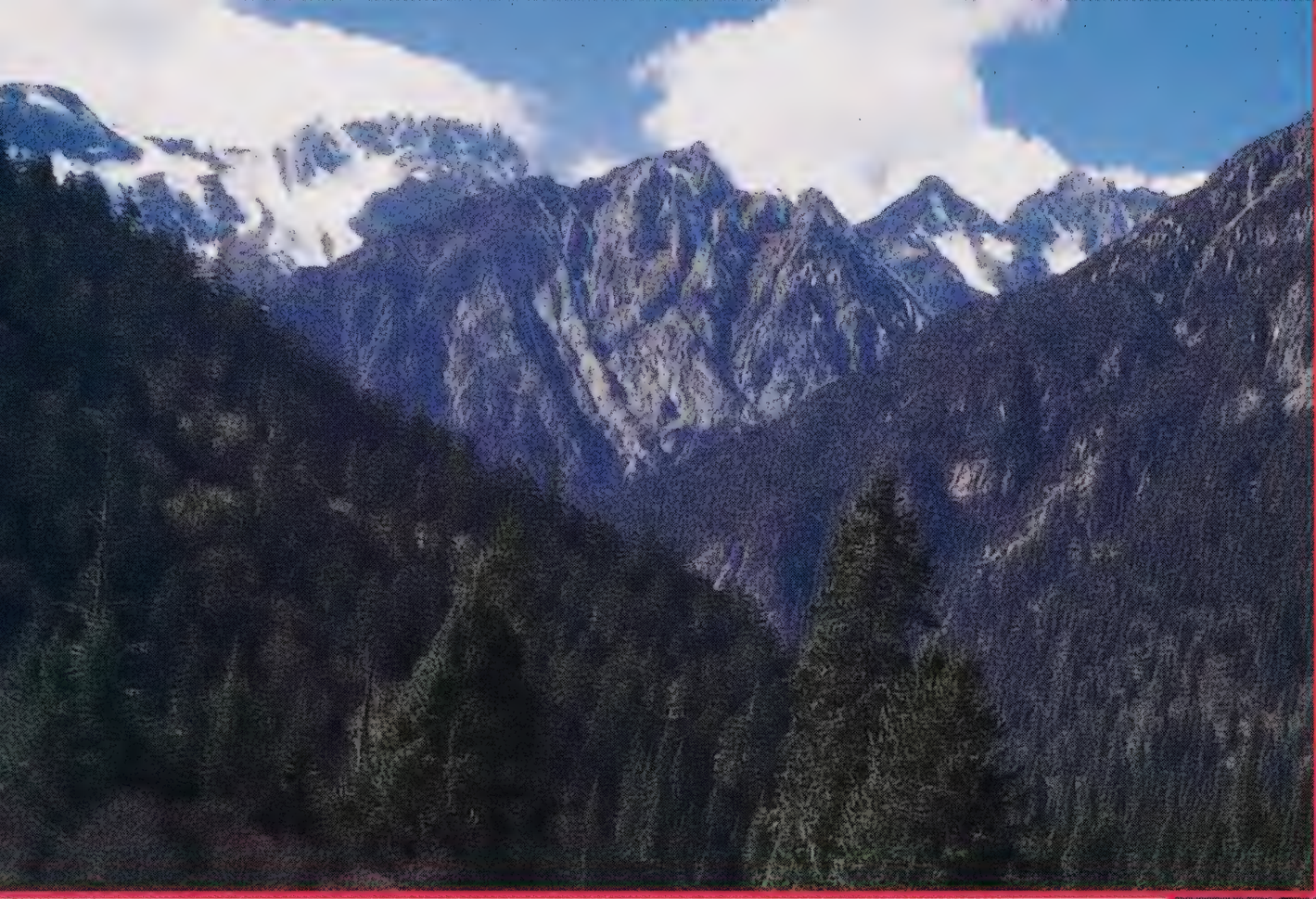
NT PANDA'S HABITAT IN PINGWU COUNTY HAS ALREADY BEEN CLEARED.

But the massive floods of the summer of 1998 resulted in a sharp increase in China's collective environmental awareness about the importance of these vulnerable upper-watershed areas in reducing floods. Previous gains from forest harvests, even for precious softwoods, and from increased grain production following forest clearance had been offset by the devastation caused by floods and landslides to downstream transportation networks and hydropower facilities. This produced a historic change in logging and land-use policy. Strong measures to reduce the risk of flooding were declared a national priority. As of November 7, 1999, a national decree banning commercial logging in these remote but vulnerable mountains went into effect.

The conservation of the remaining forests for protection against downstream flooding had become more important than the consumption of the softwoods they provided. In a briefing by Pingwu County officials that morning, they emphasized that the challenge the county now faced was how to find other employment for displaced loggers. Logging formerly employed about 3,000 people here and directly provided revenues for schools, health clinics, road building and maintenance, and other community needs. Aside from humanitarian issues, at least some of the 3,000 people looking to put food on the table could be expected to turn to poaching in reserves and other forest areas. The county representatives were therefore very interested in the integrated conservation and development project that WWF is pioneering in Pingwu County. Part of that plan involves increasing ecotourism. As we left the briefing we saw evidence of progress: A contingent of media people was leaving on what tourism promoters call a familiarization tour, which is designed to generate free publicity.

The Way to Wanglang

Leaving the farm, our little caravan continued on the road that wound along the river toward the Wanglang Reserve. John had been here in 1981 as a member of a Smithsonian-CAST (China Association of Science and Technology) group surveying areas for a possible giant panda field



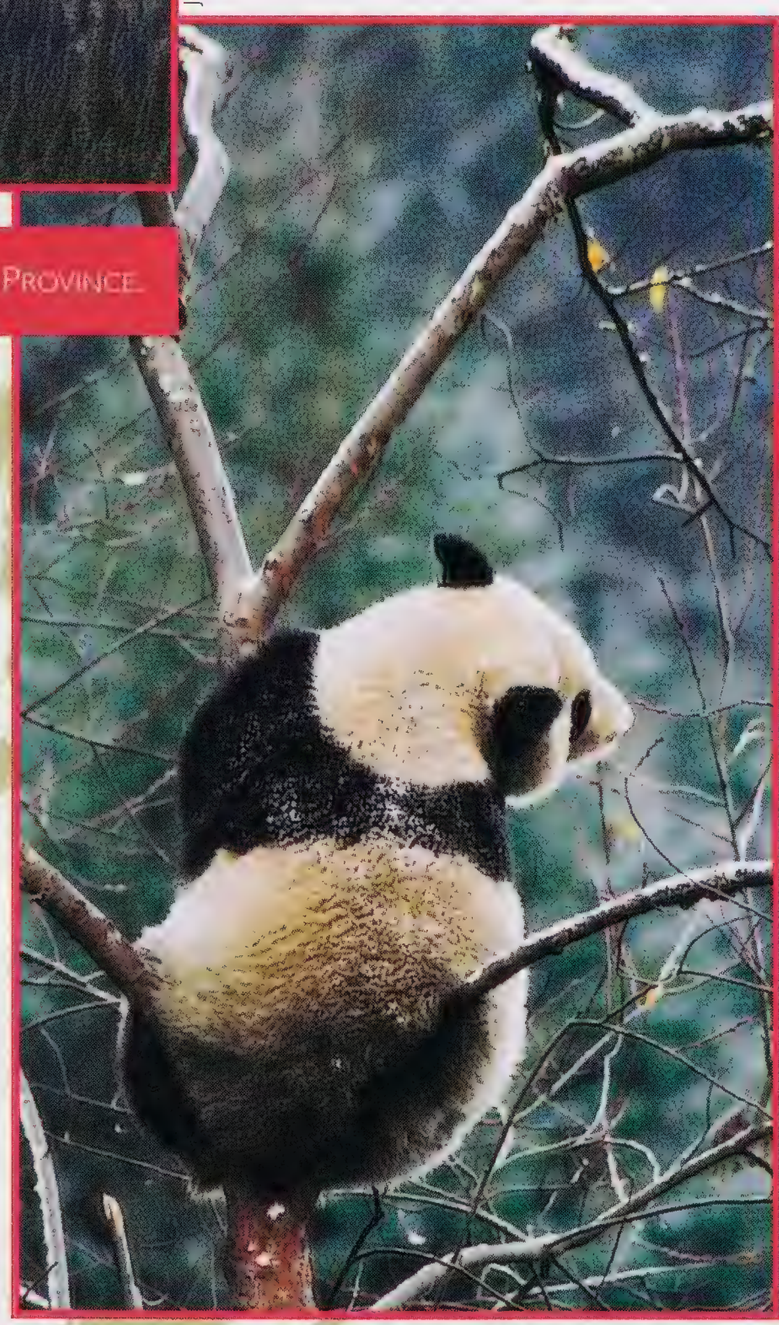
JOHN SEIDENSTICKER

THE MIN MOUNTAINS LOOM ABOVE WANGLANG RESERVE IN CHINA'S SICHUAN PROVINCE.

study. One member of our group, Wang Sung of the Academia Sinica, told us about his 1968 expedition to Wanglang to study the natural history of the giant panda. At that time, his team had to walk for four days to reach the reserve boundary. In 1981, the group had driven to the reserve in two-wheel-drive vans, traveling past picturesque villages and farms where people were plowing fields with teams of yaks. The roads are part of the logging legacy in these mountains. Now, in 1999, the landscape remained similar to what John remembered. Again we were traveling up this broad valley with occasional towns surrounded by broad, gently sloping open fields. Here again were people plowing their fields with yaks.

But at least one thing was new on this trip. We stopped for refreshments at Baima Township, a settlement of Tibetan minorities, and found ourselves being ushered into a cramped smoky kitchen with a central open fireplace. Here we were serenaded by young village women wearing traditional clothing, complete with two white pheasant tail feathers placed upright in their hair. As they sang and chanted and cooked, the ends of these tail feathers jiggled constantly, creating a festive feeling, enhanced by the strong wine downed in numerous obligatory toasts. Then we were fed freshly prepared pancakes of a sort and bits of meat from a communal pot. This was all part of a pilot program that featured local talent performing traditional rituals to attract visitors, hopefully to be translated into a new income source for villagers. Their goal is not to attract foreign ecotourists, but to increase visitation from people living in Chinese urban centers such as Chengdu and beyond.

Above this valley are forested ridges that, according to the 1998 pilot giant panda survey, were either inhabited by giant pandas living at low densities or were potential habitat for giant pandas. Valley-bottom villages like Baima Township threaten to disturb significantly the forested ridge habitats, but it is encouraging that the 1998 survey found more pandas living here than did a similar survey conducted in 1986.



JESSIE COHEN/NZP

ONLY HALF OF WANGLANG RESERVE'S HABITAT IS SUITABLE TO GIANT PANDAS.

The 124-square-mile Wanglang Reserve includes the very head of this long valley where the canyon walls start to pinch in, and clouds collect and inundate the area with rain and snow. We arrived at the reserve boundary in late afternoon and proceeded to the headquarters a few miles inside the reserve. Headquarters is home to a small staff of rangers, researchers, managers, and support staff; it also offers guest quarters. But it didn't appear to have changed much since John was here 18 years earlier: just a handful of spartan buildings around a courtyard, plus a little modern technology. A freestanding basketball hoop—minus a net—occupied a central place in the courtyard, not far from the satellite dish. The buildings were sparsely heated and dimly lit, there was no indoor plumbing, but computers hummed in research rooms. (Power comes from a micro hydro-electric plant, made possible by the area's many rivers. This plant was under construction in 1981.) As compensation for difficult living conditions, however, the site is beautiful—and pandas exist here. In fact, the best bamboo habitat for giant pandas lies up and down the canyon a few miles from headquarters at the lower end of the reserve and in bamboo forest that lies adjacent to, but outside, the reserve.

Travel in Wanglang is via old logging roads running along the main drainage, the Baima Ho (river). Just before dusk we took a walk up the road looking for tracks or whatever we might meet. John noted that bamboo had regrown since his last visit. At least two of the bamboo species here had flowered in 1976, and when John was here five years later many dead bamboo culms still littered the ground under large spruce and fir trees. But far from there being large homogenous bamboo stands like there are in other parts of the giant panda's range, the bamboo here is patchy and restricted to lower sheltered valleys and slopes, where the climate is cool and moist. Wanglang is located at the very edge of a microclimate belt that supports bamboo. Just over the major ridges, where there are very large swings in temperature and low precipitation, bamboo is absent, and so are pandas. At the highest elevations in the reserve are imposing rock faces that reminded us of the Sawtooth Range in Idaho, but which also don't support bamboo. Thus less than half of this reserve consists of habitat suitable to sustain giant pandas.

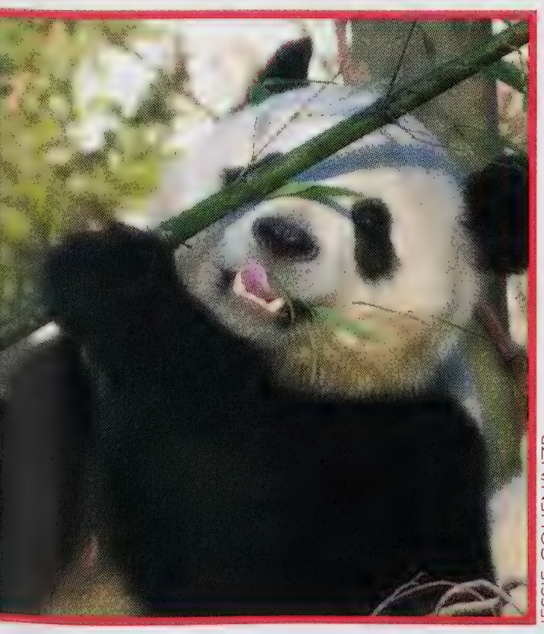
Just up the road from the headquarters is an enclosure of several hectares with eight-foot cement walls. This enclosure was constructed when

the bamboo first started to flower. The thinking at the time was that when the bamboo flowered and died en masse, giant pandas would starve. A primary bamboo species found here does flower at about 90-year intervals and its culms die. It then takes several years for the bamboo to recover fully from seeds. To save giant pandas, authorities had planned to capture and house some of them here so they could supplement their food and create a giant panda breeding center. All this had proved to be unnecessary in the end because not all the bamboo in the pandas' range or even in this reserve is the same species, and so it did not all flower and die at once. We now know there are at least 12 species of bamboo in Pingwu County. Giant pandas adjusted their movement to take advantage of whatever bamboo species was available; they move seasonally up and down the mountains to follow the availability of tender shoots and other edible parts of bamboo.

On the road we were walking along were carnivore scats that may have been a dhole's, a kind of wild dog that occurs in the reserve together with Asian black bears, leopards, musk deer, and takin. There were tigers here at low numbers at one time but they were extirpated by the 1950s. Roto-tilled mud revealed the presence of pigs, but not whether they were wild boar or domestic swine. Susan was walking in front in the gathering dusk when she signaled and whispered that she'd seen something reddish about 50 feet ahead. The russet fur of a musk deer perhaps? Then we saw a blur of blue clothing and heard the sounds of thrashing through the underbrush. Arriving at the spot, we found a yoke stick with bloody, meat-filled burlap bags tied on each end; the meat was takin. What Susan had spotted was the leading edge of the yoke's bloody package poking out of the trees into the path. There was no sign of the undoubtedly terrified poacher, who had retreated up the hillside into the forest and deep evening shadows. Lu Zhi and a Chinese colleague kept vigil at the site while we four Americans were sent racing back to headquarters to alert the reserve staff. Lu Zhi could tell that more than one person was involved from the back-and-forth whistling she heard as she waited. But the hunters did not return and the reserve rangers' pursuit failed to unearth them. Staff guessed they merely slipped home to a nearby village—and a meatless meal.

JOHN SEIDENSTICKER

DEVELOPING SUSTAINABLE FORESTRY AND HARVESTING NON-TIMBER PRODUCTS OFFER AN ALTERNATIVE VISION TO FORESTED SLOPES CLEARED AND TERRACED FOR FARMING.



JESSIE COHEN/NZP

GIANT PANDAS ARE OFTEN CAUGHT IN SNARES SET FOR OTHER ANIMALS.

Hunting and snaring hoofed mammals like takin and deer for food in these forests has a long tradition. Giant pandas are at times captured inadvertently in snares set for these food animals. But will the giant panda's long-term future be sustained by catching and prosecuting a few subsistence hunters? Killing a giant panda or a takin is already a serious crime in China; only those truly in need are likely to risk the consequences of being caught. It seems far better to pursue a giant panda conservation strategy in partnerships with local people, a strategy that offers alternatives to poaching. And this is one of the goals of integrated conservation and development programs: to encourage and reward local guardianship of giant pandas and panda habitat through sustainable economic incentives.

At dinner that evening and breakfast the next morning, one small part of this effort was in evidence. The mushrooms from these meals figure in a plan to develop a market for wild mushrooms sustainably harvested. The breakfast honey was "farmed" locally, another potentially marketable food product.

A panda conservation program that does not include the needs of local communities has little future. Already the watershed protection value of the forests has been recognized nationally as essential for the economic viability of China. Can this recognition of critical value be extended to giant pandas and other wildlife? The model program Pingwu County in partnership with the WWF-China Program is pursuing addresses this question. The key components are forest zoning; developing sustainable forestry and non-timber forest products such as mushrooms; creating conditions for ecotourism to flourish, including the preservation of old-town Pingwu; and managing protected areas with the input of local people. In all of these efforts, the need for watershed protection, the needs of giant pandas, and the very real needs of people are recognized, and the underlying economic well-being of Pingwu County is supported. This will make giant pandas stars in a process of ecological recovery and economic success.

We came away feeling that this process was off and running in Pingwu County, where people are learning that sharing space—and even a few pears—with pandas might pay off. Therein lies the future for wild giant pandas. Z

—John Seidensticker is Senior Curator at the Smithsonian's National Zoological Park. Susan Lumpkin is FONZ's Director of Communications. Together they are the editors of Great Cats and Dangerous Animals. *John is the co-editor of* Riding the Tiger: Tiger Conservation in Human-dominated Landscapes.

Under the Giant Panda's Umbrella

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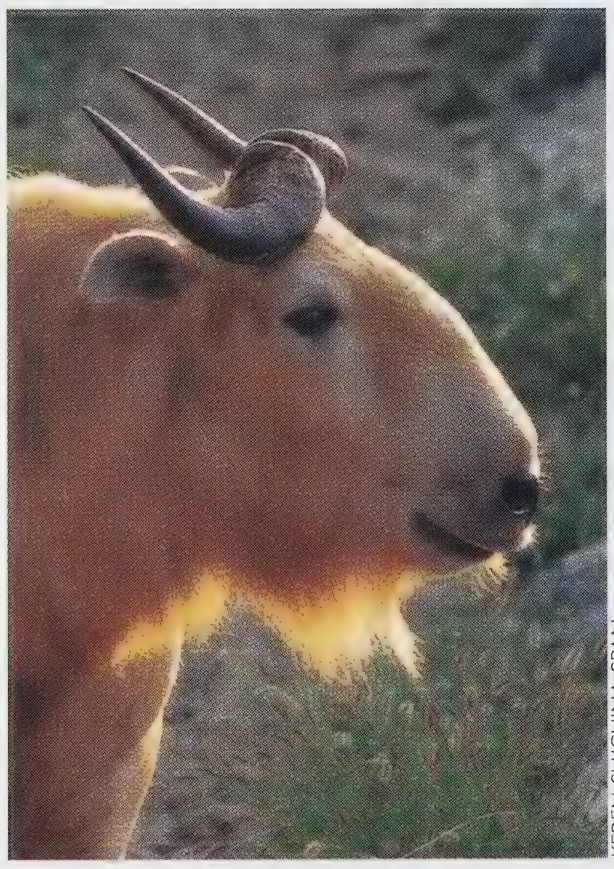
TAKIN (*BUDORCAS TAXICOLOR*)

BY SUSAN LUMPKIN
AND
JOHN SEIDENSTICKER

BACKGROUND PHOTO: WILD BAMBOO

We looked dubiously at the rotting stairs that led to the second story of the abandoned barn, then started to climb. If an 800-pound takin could negotiate the steep steps without putting a foot through a board, then so could we. Shreds of matted dirty gold fur and piles of marble-sized pellets on the barn's second floor confirmed what we'd only half-believed: Takin really were finding shelter in the derelict structure's attic.


KEREN SU/CHINA SPAN

TAKIN (*BUDORCAS TAXICOLOR*).

KEREN SU/CHINA SPAN

BABY GIANT PANDA (*AILUROPODA MELANOLEUCA*).

A mile or so from the barn, which slouched not far from the headquarters of China's Tangjiahe Reserve, the footpath along the river dwindled away. Only a takin trail snaked along the rugged valley slope. Scrambling clumsily, it was clear why no takin would retreat from a set of stairs. Despite their massive size, thickset build, and gawky appearance, takins can tiptoe up and down the most precipitous of tracks and leap from crag to crag like ballet dancers across a stage. Takins can even balance on their hind hooves to nibble on vegetation eight feet above ground. This animal's generic name—*Budorcas*—reflects this contradiction between ungainliness and grace: It means oxlike gazelle.

The takin (*Budorcas taxicolor*) is just one of several spectacular species that share the giant panda's remote and rugged landscape if not its celebrity. Others include serow, tufted deer, golden monkeys, and several species of pheasant. Leopards, clouded leopards, wild dogs, musk deer, and Asiatic black bear also make appearances. While giant pandas receive all the attention, conservationists are quietly working to save some of these less acclaimed but equally endangered animals and their habitats.

This area of China is embedded within Conservation International's "Hengduan Mountains of South Central China Hotspot." CI has identified 25 regions as being the highest priority for conservation action and investment. These hotspots possess high biological diversity and high levels of endemism—that is, species found there and nowhere else. The giant panda, for instance, is endemic to central China. The hotspots themselves are also considered fragile, and highly threatened.

In Wolong Reserve, the best studied of this region's parks, live some 93 species of mammals, 275 species of birds, 20 reptiles, 17 amphibians, and nine fishes. For comparison, Great Smoky Mountains National Park in the eastern United States, which is the same size as Wolong (about 775 square miles), supports about 62 mammal species, 230 birds, 35 reptiles, 34 amphibians, and 85 fish. Both of these protected areas fall into the World Wildlife Fund's Global 200 list of priority ecoregions; both are considered among the world's most diverse temperate forests.

Plants in the two regions are surprisingly similar. Walking among rhododendrons, dogwoods, oaks, and firs, we felt as at home in the Sichuan forests as we do in the forests of Rock Creek Park in our own backyard. Some are familiar because many of our flowering ornamentals hail from these forests, including varieties of azaleas, lilies, and peonies. Wild peonies are threatened in China, where people use their roots as medicine.

Others evoke home to us because there are a significant number of species pairs or larger species groups that inhabit both eastern Asia and eastern North America. A French Jesuit first remarked on this pattern in 1716, when he discovered American ginseng (*Panax* sp.) near Montreal after reading about Chinese ginseng. Ever since then, biologists have puzzled over this phenomenon, because such a large distance divides these closely related species, with no relatives connecting them. (It even has a name, the "Asa Gray disjunction," after the 19th-century Harvard University botanist who was a leading proponent of his friend Charles Darwin's theory of evolution by natural selection. Gray's description of the close affinities between the plants of eastern Asia and eastern North America was cited as key evidence of the theory.) Scientists now suspect that forests stretched continuously across North America, Europe, and northern Asia, connected by Bering Sea and North Atlantic land bridges. When rising sea levels submerged the land bridges and colder, drier conditions came to prevail across parts of this expanse, some plants disappeared from western North America and western Eurasia but remained in East Asia and eastern North America.

About 4,000 different species of plants grow in Wolong Reserve, of about 12,000 in the region, including about 245 that are rare or endangered. The endangered dawn redwood (*Metasequoia glyptostroboides*), for instance, was discovered by Chinese scientists only in 1941. Found in the wild only in a few mountain valleys, it is considered a living fossil—the last of a once much larger group of trees. A unique deciduous conifer, it grows rapidly to reach 70 to 100 feet. Some seeds were planted in the United States and Europe in 1947, and today dawn redwoods are widely grown ornamentals. Several grow in Beaver Valley at the Zoo.

The region harbors another sweet resource: It is home to the wild ancestors of many of our favorite fruits, including apples, pears, plums, and cherries. There is a growing recognition of the importance of conserving wild varieties of domestic crops as a source of genetic material. Wild species may carry genes that confer resistance to disease, for example.

Botanizing through giant panda country may be more rewarding than wildlife watching, at least for people like us with only a few hours on a couple of cool November days to spend in those woods. The Tangjiahe Reserve boasts a small natural history museum, its specimens

BOTH PEOPLE AND PANDAS ENJOY EATING BAMBOO SHOOTS.

KEREN SU/CHINA SPAN

BROWN-EARED PHEASANT (*CURSSOPTILON MANTCHURICUM*).

tantalizing us with what we might see. But takins were our only reward. This is a wild place that rewards patient vigilance over days and weeks, but like all such spots, it carries an aura of impending surprise. Around any curve in the trail, behind any bush, through any screen of leaves, you might confront some rare and wonderful creature.

Like a takin. A takin might pass for a weird, impossible cross between a moose, a cow, and a bear. In fact, the takin's closest cousin is the musk ox. And, although sometimes called golden-fleeced cows, takins are more closely related to sheep and goats than to bovines.

Takins inhabit rugged, mountainous terrain, ranging from 4,000 to 14,000 feet, where they break trails—really narrow ruts—in dense thickets of rhododendron and bamboo to travel between foraging areas. They migrate vertically, moving from high-elevation alpine habitats in the summer to forested valleys in the winter. Menus change with the seasons, too, according to what is available to eat. Zoologist George Schaller, who observed these animals during his study of giant pandas in China, documented the catholic food habits of takins. According to Schaller, "Takins eat almost any plant within reach of their broad mouths," including the tough leaves of evergreen rhododendron and oak, willow and pine bark, horsetails, bamboo leaves, and a variety of more succulent, new-growth leaves and herbs. Takins in one herd ate 27 different items while foraging through a single field.

Schaller also noted an unusual feature of the takin's social system. Groups of young takin—Schaller saw up to 16—are often tended by just one baby-sitting female while the other mothers forage and socialize. In general, takin society appears fluid. While females and youngsters live in groups, males are generally solitary, but may associate with a group of females and young, or with other males. Groups of ten to 35 animals were seen, but sometimes these groups coalesced into a larger herd of 100 or more. A salt lick is often the magnet that attracts such large groups.

Even a large group of takins dotting a distant slope can easily be overlooked in the dense vegetation. Through binoculars at dusk, we squinted to resolve pale golden specks into large furry ungulates on the cliff across the river. Only their measured movements gave them away. In this part of China today, predators able to take down an adult takin—such as leopards, wild dogs, and tigers—are scarce or have been extirpated. At higher elevations, snow leopards, with their adaptations for hunting prey in rugged mountainous habitat, may kill takins. The takins here are wary nonetheless, perhaps fearing the human predator.

Local people hunt takin for their highly prized meat, and poaching is reducing their numbers throughout the species's range. Just the day before in Wanglang Reserve, not more than a few miles from headquarters, we had almost tripped over a poacher carrying the carcass of a takin through the forest.

Deforestation has also taken its toll on takin, as it has on most wildlife. Two of the four subspecies of takin are found only in central China, a range roughly overlapping that of giant pandas. One of the subspecies—the golden takin (*B. t. bedfordi*)—is listed as endangered, while the Sichuan takin (*B. t. tibetanai*) is listed as vulnerable by the World Conservation Union. Two other suspecies' ranges are in the Himalaya, including parts of Burma, Tibet, Bhutan, and India. Of these, the Bhutan takin (*B. t. whitei*) is considered vulnerable, and the Mishmi takin (*B. t. taxicolor*) is endangered. China extends the takin its highest level of legal protection: Like the gianda panda, the takin is officially a national treasure.

Although little known, serow (*Capricornus sumatraensis*) are widely distributed in tropical and subtropical Asia, including the mountains of Sichuan. Serow are relatively small ungulates, weighing up to 300 pounds, with long tasseled ears, short sharp horns, and short solid hooves. The Chinese name for the serow means "cliff donkey," but serow are related not to donkeys, but rather to mountain goats and chamois. These fairly solitary animals live on cliffs and on brush-covered mountains between 3,000 and 12,000 feet, where they have been described as "adept at dashing wildly down impassible precipices."

This animal's generic name—*Budorcas*—reflects this contradiction between ungainliness and grace: It means oxlike gazelle.

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DHOLE (*CUON ALPINUS*).

KEREN SU/CHINA SPAN

RED PANDA (*AILURUS FULGENS*).

Serow are thought to be selective browsers on leaves and other plant parts, but few particulars are known about their food habits, or, indeed, about other aspects of their behavior and ecology.

More Gold

Another of China's endangered treasures is the golden snub-nosed monkey (*Pygathrix roxellana*), which ranges from the high mountain forests of Sichuan to the Tibetan border. One of just a handful of primates adapted to life in a temperate climate, these beautiful long-haired monkeys sport orange fur on much of their body and pale-blue patches above the eyes and nose. One observer wrote, "...their nose looks as if a bright blue butterfly was sitting with its wings open in the middle of their face...."

The arboreal golden monkeys are leaf-eaters, but supplement their diet with fruit, seeds, insects, birds, and bird eggs. Large troops of up to 600 individuals have been reported, but where their habitat is disturbed, troops may number only 30 to 100 monkeys. The troops are subdivided into small groups composed of one adult male, about five adult females, and their offspring. Little more is known about the lives of golden monkeys. One well-known fact, however, is that they are vulnerable to extinction. Long hunted for their fur, which is fashioned into coats, and for other body parts used in traditional medicine, golden monkeys are offered China's highest level of protection, the same as giant pandas, and hunting is forbidden. These primates, which are estimated to number between 6,000 and 14,000 individuals, remain threatened by continued habitat fragmentation and destruction.

Diverse Deer

Deer of several kinds find homes in central China. Tufted deer (*Elaphodus cephalophus*) little resemble the familiar American white-tailed deer (*Odocoileus virginianus*). Tufted deer stand just 25 inches at the shoulder, and the male's very small, unbranched antlers are almost completely hidden by tufts of hair on the forehead. Males also possess undeer-like long, sharp canine teeth that extend like small tusks or fangs over the bottom lip. Male tufted deer probably use these canines in fights with other males, just as male muntjac (*Muntiacus* sp.)—another small deer found in panda habitat—use their similarly long canines in fights over territory and females. Tufted deer live at altitudes up to about 15,000 feet in high valley and mountain forests.

Musk deer (*Moschus* sp.) live in giant panda habitat too. Five species of musk deer (some experts say four, others six) live in various parts of China; two overlap with giant pandas. Slightly smaller than tufted deer and muntjacs, musk deer lack antlers entirely, but their fangs grow up to three inches long (think of them as dracula deer). The word musk derives from an old Indian word for testicles, and refers to the glands enclosed in sacs found near the male musk deer's genitals. The scent of the secretions of these glands—musk—may attract females for mating. People have hunted these deer for their prized musk for centuries to use in perfumery and in traditional medicine. Musk is still an ingredient in 300 to 400 manufactured medicines, although most musk used in perfumery is now synthetic. TRAFFIC, the wildlife trade watchdog, estimates that China alone may use as much as a ton of musk annually. And with each gland containing only tiny quantities of musk, it may take as many as 100,000 male musk deer to meet this quota. As a result of hunting and poaching, coupled with habitat loss, musk deer are considered near threatened, and efforts are underway to reduce both legal and illegal harvesting and trade of musk. What's more, giant pandas are sometimes snared in traps set for musk deer, creating another hazard for the beleaguered bears.

Found only in a small area in central China and Tibet, the 300-pound white-lipped deer (*Cervus albirostris*) resemble white-tails but are adapted for life in high-elevation habitats. Like takin, white-lipped deer can easily climb rocks and negotiate steep slopes. Males sport huge racks during the breeding season: Their multi-tined antlers may extend more than four feet tall and weigh 15 pounds. This species is considered vulnerable by the World Conservation Union, but it may number as many as 100,000 individuals. These deer are farmed in China, where their velvet antlers—the stage before the antlers turn bone-hard—are used in traditional medicine.

Fantastic Flyers

Wakening early in Wanglang, we hear the calls of pheasants that comprise part of the characteristic soundscape. The mountains of central China are home to nine of the world's 48 species of pheasant, including four species found nowhere else. These large, forest-dwelling game birds are best known for the often spectacular plumage of males. While female pheasants' drab markings in shades of brown and gray blend into the colors of the forest, male markings are like bright beacons, with bold patterns in brilliant colors. The males of two of central China's pheasant species are among the gaudiest: Lady Amherst's pheasants (*Chrysolophus amherstiae*), also known as flower pheasants, shine with patches of crimson, yellow, orange, blue, and metallic green. Golden pheasants (*C. pictus*)

KEREN SU/CHINA SPAN

GOLDEN SNUB-NOSED MONKEY (*PYGATHRIX ROXELLANA*).

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GOLDEN PHEASANT (*CHRYSOLOPHUS PICTUS*).

glitter with a long, bright-yellow crest and crimson underparts, and spots of green and blue and more red and yellow on their band and tail.

Other Sichuan pheasants include Temminck's tragopan (*Tragopan temminckii*) and the white-eared pheasant (*Crossoptilon crossoptilon*)—both of which can be seen at the Zoo—as well as Reeve's long-tailed pheasant (*Syrmaticus reevesi*) and the endangered Chinese monal (*Lophophorus lhuysi*). All of the pheasant species, which with one exception live naturally only in Asia, are threatened. They are good to eat and have been intensely hunted throughout their range. As sedentary ground nesters and feeders, they are vulnerable to habitat destruction and the impact of livestock, such as goats, which compete with them for food.

Across the border in the Qinling Mountains of Shaanxi Province, the last crested ibises (*Nipponia nippon*) in the world cling precariously in patches of pine forest. These beautiful wading birds were widespread until the mid-1800s, breeding in southeast Siberia, northeast and central China, North Korea, and Japan. But shooting, logging of pine woodlands, and fertilizers and pesticides fouling rice paddies and wetlands where they feed on insects, amphibians, crustaceans, and fish all took a devastating toll. They disappeared in Siberia, North Korea, and most of China. Japan's last five birds were captured from the wild in 1980, but the breeding program failed. In 1999 and again in 2000, two ibises sent to Japan from China to revive the program produced a chick, bringing Japan's captive ibis population to four. Only in Shaanxi did wild birds hang on, and, thanks to Chinese conservation efforts, this population has grown from as few as seven to a few dozen or more today. Some are also in conservation breeding programs in China. In total, about 50 ibises remain.

Predators

With such a banquet of potential prey, it's no surprise that many species of carnivore lurk in the forests of central China. Tigers have been extirpated, perhaps leopards as well. But five other cats still hunt in parts of the region. Small Pallas's cats (*Otocolobus manul*) with snub noses and lush golden fur slink among rocks at high elevations. Husky Eurasian lynx (*Lynx lynx*) probably live on roe deer, while agile snow leopards (*Uncia uncia*) stalk blue sheep. Clouded leopards (*Neofelis nebulosa*) have lived here in the recent past, and may still. Eight kinds of mustelids including river otters (*Lutra lutra*), hog badgers (*Arctonyx collaris*), and tiny least weasels (*Mustela nivalis*) find niches here, too.

And then there are wolves (*Canis lupus*), dholes (*Cuon alpinus*), two species of fox (*Vulpes ferrilata* and *V. vulpes*), and two more bears, the Asiatic black bears (*Ursus thibetanus*) and brown bears (*U. arctos*). Some scientists speculate that giant pandas couldn't compete with all of these carnivores and had to give up a meatier diet and eke out an existence on the meager fare of bamboo. Red pandas (*Ailurus fulgens*) also dropped out of the race and take advantage of the same bamboo that giant pandas do.

ASIATIC BLACK BEAR (*URSUS THIBETANUS*).

And People

Driving between Wanglang and Tangjiahe, we travel through isolated farms and small villages, through growing towns and the bustling but smallish city of Pingwu. This region feels rural and remote, like Idaho, or the past. But the farmhouses perched on defiles are festooned with satellite dishes capturing television signals amid the drying garlands of red peppers and pale yellow corn on the cob. Nowhere is truly faraway anymore, so we can no longer think of wildlife and wild lands surviving in some pristine, people-free place.

The fate of all of the wildlife and wild lands of central China is tied to the future of giant pandas, which act as umbrellas to shelter the lesser known inhabitants of the ecoregion. So is the fate of the millions of people living there who depend on the natural resources of the area as completely as the other creatures with which they share it. Z

—Photographer Keren Su has recently published a book on pandas. He also conducts tours to visit the panda in its native home of China. China Span's website can be found at www.chinaspan.com, or contact China Span at 425.882.8686 or via email at webmaster@chinaspan.com for details.

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BIO-ALMANAC

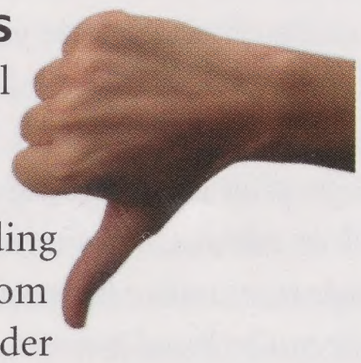
GOOD NEWS

Kemp's ridley turtles (*Lepidochelys kempii*) along the Gulf coast of Texas have reason for cheer. The Texas state government has closed its shoreline to commercial shrimping indefinitely to protect these critically endangered sea turtles, which converge on Padre Island during a spring and early summer nesting season. The state has also placed new regulations on shrimp trawling gear and "turtle excluder devices" in an effort to bolster the dwindling populations of five sea turtle species found off the Texas coast.

The main nesting site for Kemp's ridleys is a five-mile stretch of beach in the Mexican state of Tamaulipas, whose adjacent waters are protected by a no-fishing zone. Fewer than 2,000 female Kemp's ridley turtles are coming ashore each year on the Mexican coast—down from 40,000 turtles observed nesting during a single day 50 years ago—while only 16 ridley turtle nests were observed on Texas's Padre Island last year. Conservation groups are pushing the U.S. government to create a 100-mile-long marine reserve at Padre Island to ensure year-round protection for turtles nesting north of the border.

—from Sea Turtle Restoration Project and Enn.com

BAD NEWS



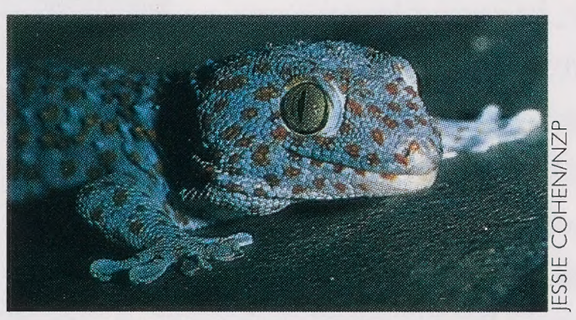
All is not well in the Gulf of Mexico, however. Invading jellyfish from Down Under may pose a threat to shrimp and other marine life there. Native to Australian coastal waters, spotted jellyfish (*Phyllorhiza punctata*) first arrived in the Caribbean Sea two decades ago, transported perhaps as polyps stuck to the hulls of ships coming through the Panama Canal. This past summer, however, marked the first time the giant jellies—which have been blooming to two feet in diameter, four times their average size—reached the northern Gulf along the U.S. coastline.

The largest concentration of more than a million spotted jellyfish appeared at the mouth of Lake Borgne near New Orleans. By September, the jellyfish had begun to disappear, but their polyp "babies" may be currently attached to hard underwater structures, awaiting the warmer waters of spring to reappear in even greater numbers. With only a mild sting, these jellies aren't considered a threat to humans, but they are voracious consumers of zooplankton—small crustaceans and fish larvae that drift in clouds near the surface of the water—and thus may threaten local marine biodiversity, not to mention the shellfish industry. Jellyfish are considered a delicacy in some Asian countries; harvesting the alien jellies may offer one solution to this gooey mess.

—from seagrantnews.org *(8/9/00)*

ATOMIC LIZARDS!

Geckos can hang out just about anywhere—trees, walls, even ceilings—thanks to atomic energy pulsing in every step they take. In an article in the journal *Nature*, scientists from Lewis and Clark College, Stanford University, and the University of California at Berkeley report that tokay geckos (*Gekko gecko*) from Southeast Asia stick to surfaces not with glue, suction, or moisture—as other clingy animals do—but through intermolecular forces generated by millions of hairs lining the bottoms of their toes.



JESSIE COHEN/NZP

TOKAY GECKO.

The researchers suspect that van der Waals forces—which generate significant forces only when two objects are in very close contact—may explain the lizards' stick-to-itness. Van der Waals forces bond molecules together when unbalanced electrical charges between adjacent molecules attract. Each tiny hair on the geckos' toes bears hundreds of thousands of microscopic spatula-like tips that interact with the molecules of the surface to which they are pressed.

Inspired by this research, scientists at the company iRobot have built a "Mecho-Gecko" to study this phenomenon further. Researchers envision a robotic window washer, a Mars rover with gecko feet, and cars better equipped to stick to the road.

—from Nature *(6/8/00) and* Discover

WHAT'S IN A NAME?

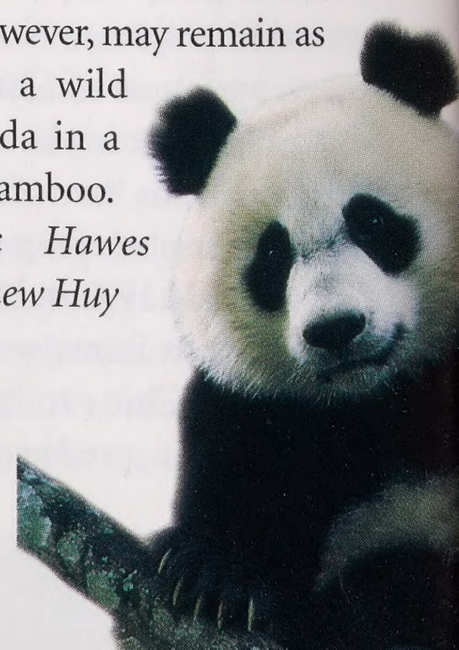
Understanding the derivation of the word "panda" is not a black-and-white issue. The first appearance of the giant panda in literature occurred more than 3,000 years ago in *The Book of History* and *The Book of Songs* (the earliest collection of Chinese poetry), which both referred to the creature as *pi* and *pixiu*. Other accounts from early Chinese written history gave the panda three more names—*mo, zhi yi,* and *bai hu*—and described the creature as a white fox, a white leopard, and similar to a tiger or a white bear.

As if the identity of this bamboo-eater wasn't confused enough, the giant panda in later literature was dubbed *meng shi shou* (beast of prey), *bai bao* (white leopard), *shi tie shou* (iron-eating beast), and *zhu xiong* (bamboo bear). To this day, the Chinese name for the giant panda is still under dispute. Is it a banded bear (*huaxiong*), a catlike bear (*maoxiong*), a bearlike cat (*xiongmao*), or a great bear-cat (*daxiongmao*)?

The academic community even had problems deciding on a name. Attempting to give the giant panda its first scientific name, Père Armand David placed the species in the bear genus, *Ursus*, and labeled the species *Ursus melanoleucus* in 1869. About a year later, Alphonse Milne-Edwards correctly placed the species in its own separate genus and christened the animal *Ailuropoda melanoleuca*, meaning "cat-footed, black-and-white animal." This Latin name has stuck.

Altogether, the creature has received nearly 20 different Chinese names, yet none resembles "panda." One of the few known candidates for the root of the word panda is *pónya*, possibly derived from a Nepali word referring to the ball of the foot. Other writers believe that "panda" came from *wah*, the Nepali name for the red panda (*Ailurus fulgens*), and originating from the childlike sound that this species sometimes makes. The ultimate answer, however, may remain as elusive as a wild giant panda in a forest of bamboo.

—Alex Hawes and Matthew Huy



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